



***** IN THIS ISSUE *****

Feature

Intel Architecture Servers: The Unifying Architecture for Enterprise Computing

Intel's Vice President of Enterprise Servers, John Miner, kicks off this month's Server focus issue with a look at the trends and technologies driving Standard High Volume (SHV) servers.

***Get the technology details in the Focus article from
Intel's Server Architecture Lab with Intel Fellow, Justin Rattner***

Top Stories

Pushing the Envelope of Platform Technology – the Intel Developer Forum

The second bi-annual Intel Developer Forum is rapidly approaching on February 17th-19th. Get all the details and background on this significant technology event designed to provide all the latest tools and techniques for advanced platform technology implementation.

Common Ground for Server Management Hardware

A new specification, soon to be announced by Intel and leading server system vendors, defines a common interface and bus protocol for platform management hardware, filling a void in server management standards.

Defining a Specification for Server System Infrastructure (SSI)

Intel is working with leading server vendors and industry suppliers to define a specification for common server system elements that vendors frequently have to redesign with each product generation—a proprietary, expensive and time-consuming process.

Increasing Competitive Advantage with I₂O[®] technology

BMC Software Vice President, Kirill Tatarinov, describes how the new PATROL[®] Management Suite and I₂O Application Management Toolkit works with I₂O technology to improve manageability of I/O devices for optimal performance and availability.

Q&A on Standard High Volume (SHV) Servers

For a short overview of SHV servers, their impact on the computer industry, the economics of volume model and Intel's role in enabling the industry, read this Q&A with Intel's Director of Server Platform Marketing, Mitch Shults.

Platform News and Information

***** Check out our Platforms, Technologies and Events pages *****

Every month we cover the latest developments in platform initiatives and technologies. Our "Platforms" pages provide news on the latest trends and initiatives for the business, home, mobile, server and workstation platforms. Our "Technologies" pages give you quick and detailed information on the industry status of specific platform technologies, from the emergence of the Accelerated Graphics Port (AGP) to the latest advances in Intel microprocessors, memory, Audio, USB, 1394, DVD, Power Management, and PC 98. Our "Industry Events" page keeps you up to date on upcoming industry gatherings targeted at the platform and peripheral developer.

Technology News

This department is your source for the hottest technology and product announcements, white papers, design guides, specifications, tools and developer events available to the industry.

- **Intel Developer Forum coming on February 17th – Register Today!**
(<http://developer.intel.com/design/idf>)
- Intel Delivers Fastest **Pentium® II processor at 333 MHz**
(<http://www.intel.com/pressroom/archive/releases/dp012698.HTM>)
- Intel Soon to Announce new **Server System Infrastructure (SSI) Initiative**
(<http://developer.intel.com/solutions/tech/ssi.htm>)
- New **Mobile Pentium® processors with MMX™ technology** reach 266 MHz
(<http://developer.intel.com/design/mobile/>)
- New Server technology page available on **Server Platform Management Hardware**
(<http://developer.intel.com/solutions/tech/platmgmt.htm>)
- **Maximizing AGP Performance** – New AGP White Paper Now Available
(<http://www.agpforum.org/downloads/guide2.pdf>)
- **PC 99 System Design Guide** – industry review dates now planned
(<http://developer.intel.com/solutions/tech/pc98.htm>)
- Intel Security Specification **CDSA 2.0 Adopted by The Open Group**
(<http://www.opengroup.org/press/6jan98.htm>)
- Intel expands investment in Server Activities with new Design Center
(<http://www.intel.com/pressroom/archive/releases/SP010998.HTM>)
- New web page showcases the **Opportunity for Home Networks**
(<http://www.intel.com/home/network/>)
- **Virtual Interface Architecture** spec 1.0 now available for download
(http://www.viarch.org/html/Spec/vi_specification_version_10.htm)

Reader Services

If you are new to *Platform Solutions* and would like to receive this companion newsletter to the on-line version, please visit *Platform Solutions* on-line and go the "Subscribe Now" section to register and sign up for delivery. The on-line version provides lots of direct links for quick access to the developer information and news reported in each issue, whether it's on Intel's web site or industry web sites.

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On behalf of all of us at Platform Solutions, welcome to the future of the PC platform!

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platform news for the hardware developer

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Feature:

Intel Architecture Servers: The Unifying Architecture for Enterprise Computing

by John Miner
Vice President and General Manager
Intel Corporation, Enterprise Server Group

Today's server technology is changing at a rapid pace. We begin 1998 at a strategic inflection point that will have considerable influence over the next few years. The proliferation of the Internet continues to accelerate the growth rate of the server market, which Intel believes may be more than 30% through the end of this century. In this period of rapid growth and technology evolution, the Intel Architecture is becoming the unifying architecture for enterprise computing.

Standard high-volume (SHV) servers based on the Intel Architecture (IA) are proving they can handle the complex information needs of large enterprises. In the same way that price/performance advantages of IA have had a significant effect on PC platforms, they're poised to alter the dynamics of server platforms across all segments of the server marketplace.

Intel is working with the industry to enable new server platform technologies that pave the way for server growth and assist server system and hardware vendors in their product development decisions. In addition to core IA microprocessor technology, you can expect to see developments from Intel in four server technology areas:

- **Clustering**—Focusing on the Virtual Interface (VI) architecture and distributed message passing (DMP), Intel is paving the way for clustering applications that link multiple SHV servers together, enabling them to operate as a single entity in today's complex client/server networks.
- **I/O**—Scaling the input/output bandwidth capabilities of IA-based servers with next-generation I/O technology solutions represents an important part of Intel's server platform activities moving forward.
- **Manageability**—As part of Intel's Wired for Management (WfM) initiative, we are helping to develop a number of different specifications designed to improve server management functionality and lower total cost of ownership for the large enterprise.
- **System Infrastructures**—Intel is actively working to help define a specification for tomorrow's server system infrastructures (SSI), whereby the industry can develop a common set of server elements that lay the groundwork for future growth in the IA server market.

To get the details around these ground breaking technologies, you should read the top stories in this month's *Platform Solutions*—led by a **Focus article** from Intel Fellow and Server Architecture Lab Director Justin Rattner. Justin, as well as other top Intel server architects will also be on hand at the February 17th **Intel Developer Forum (IDF)** (<http://developer.intel.com/design/idf>) to provide the latest implementation details of these new technologies. IDF represents Intel's focus on working with the industry to accelerate the adoption of standards-based platform technologies.

Whether it's SSI, WfM server specifications, or other revolutionary innovations such as Intel's 64-bit microprocessor architecture, Intel is doing its part to help bring PC economics to the server marketplace. This will surely open many new opportunities for server system hardware vendors alike in the years ahead.

About the Author:

John Miner is Vice President and General Manager of Intel Corporation's Enterprise Server Group. He is responsible for all Intel Architecture building blocks and industry initiatives related to server technology.

For More Information:

To understand more of the market dynamics and Intel's role behind SHV servers, read the **Q&A on SHV Servers** with Intel's Server Platform Marketing Director, Mitch Shults.

(<http://developer.intel.com/solutions/issue/stories/top2.htm>)

To get all the details around **IA SHV server technology**, be sure to read the Focus article in this month's *Platform Solutions* from Intel's Server Architecture Laboratory by Justin Rattner and Paul Close.

(<http://developer.intel.com/solutions/issue/focus.htm>)

For more information on **Intel's server management technologies**, read the top story in this month's *Platform Solutions* by Intel's Director of Marketing for High-End Servers, Kevin Soelberg.

(<http://developer.intel.com/solutions/issue/stories/top3.htm>)

For details about **Intel's SSI initiative**, read the top story in this month's *Platform Solutions* by Intel's General Manager of Entry/Mid-Range Servers, Abhi Talwalker.

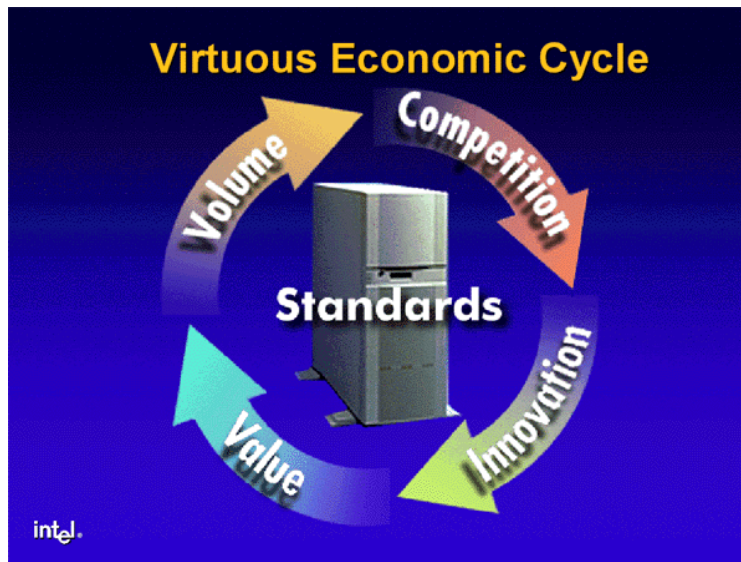
(<http://developer.intel.com/solutions/issue/stories/top4.htm>)

Focus:***Growing the Standards Base for High Volume Servers***

By Justin Rattner and Paul Close
Server Architecture Laboratory, Intel Corporation

Andy Grove, Intel's CEO and Time Magazine's Man of the Year, coined the term "standard high-volume server" in his 1994 speech at Uniforum. He confidently told the UNIX* server community that it would soon find itself under the same technical and financial pressures which forced the personal computer industry to standardize around the IBM PC architecture in the early 1980s. Four years later, much as Grove predicted, the server industry is aggressively building the base of hardware and software standards that will fully define the industry-standard high-volume (SHV) server. Intel's Enterprise Server Group is actively engaged in all of the major server standards effort and is bringing its focus and leadership to core efforts in input/output, clustering, packaging and manageability.

The personal computer industry is defined by a broad set of hardware and software standards that have evolved from the original IBM PC/AT over nearly two decades. Thousands of companies compete to produce the best possible PC products compliant with these standards. The resulting competition drives innovation as each company strives to deliver the best possible implementation of these standards at the lowest possible price. The result is a personal computer industry that constantly increases customer value by offering better performance, capability and quality. The increasing value fuels further market growth, which attracts still more companies to the expanding market opportunity. As new competitors join the battle, the "virtuous economic cycle" begins again.



For SHV servers to enjoy the benefits of the virtuous economic cycle, the volume server industry is actively cooperating to define a core set of hardware and software standards. Many of the initial standards are being taken directly from the PC industry, like *Intel Architecture microprocessors* and the *PCI bus*. Some, on the other hand, are new and unique to servers, like the *Intelligent I/O (I₂O)* initiative. Still other standards, like *Wired for Management*, have distinct versions that recognize unique requirements of servers. In this article, we provide a brief overview of the many SHV standards efforts currently underway and forecast some of the next areas to be targeted for standardization.

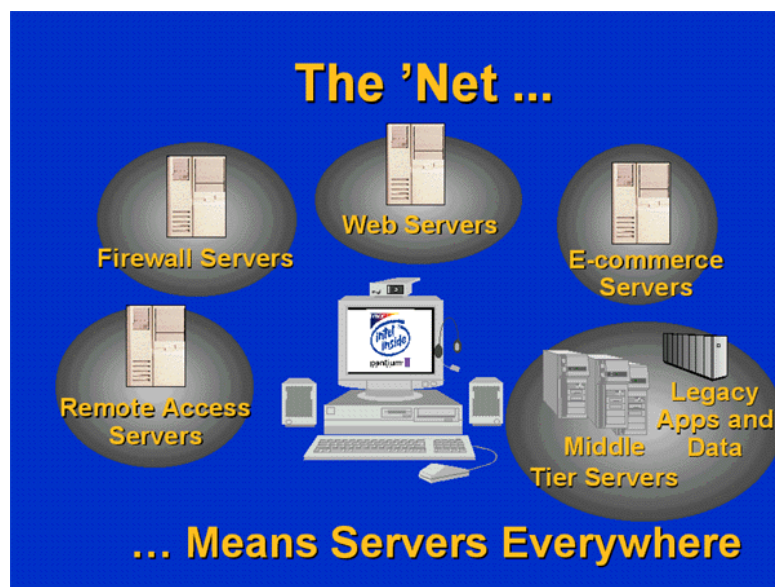
SHV Origins: The PC Server

The dramatic price-performance advantage of personal computer technology first came to servers through the efforts of end users searching for creative ways to deploy PCs as servers. Some of the earliest examples of SHV servers were simply PCs stocked with enough memory and disk to provide shared file storage and print spooling for networks of other personal computers. These PC servers were soon tasked to provide e-mail services for PC networks and to act as network gateways to legacy minicomputer and mainframe systems. The success of PC-based servers convinced a number of leading computer manufacturers to recast their high-volume PC technology in the form of purpose-built servers. Featuring more processors, memory, and I/O capacity than their desktop cousins, PC servers brought the value of the high-volume technology to server applications while avoiding most of the limitations of the typical desktop computer.

With the rapid advancements in microprocessor performance and symmetric multiprocessor system design, PC servers are no longer limited to file/print or e-mail services. The very term "standard high volume server" is a quiet acknowledgment that today's SHV product is no longer a well-endowed PC, but a highly competent, enterprise-ready, database and application server. The proof can be found in the industry-leading performance and record-shattering price/performance delivered by SHV servers on the industry's most popular database applications and three-tiered enterprise application suites. It's no surprise that millions of SHV servers are deployed throughout small and large business computing environments around the world.

The Internet as the Killer Server Application

The newest volume driver for the SHV server is the Internet, particularly the World Wide Web. The phenomenal growth in both Internet clients (both PCs and appliances) and Web pages is pushing volume server demand beyond the most optimistic market forecast of just a year ago. Server market growth is expected to continue unabated for the next five years. IDC, for example, forecasts the number of URLs (i.e., Web pages) will grow from less than 500 million in 1998 to an estimated 4.5 billion in 2002. At the same time, page complexity will skyrocket from a few kilobytes per Web object to hundreds of kilobytes with more animation, video, and interactivity. Servers, particularly standard high-volume servers, will be the principal repository and deliver the vast majority of these new Web pages.



We should also note that HTTP and FTP servers are only the tip of the iceberg when it comes to Internet-driven server demand. The Internet architecture relies on servers to do just about everything except display HTML code. Internet communication tasks previously handled by custom hardware routers are being turned over to volume servers attached to high-speed switches. Servers are at the heart of remote access, firewall and proxy capability. They are essential in the rapidly growing area of electronic commerce providing catalog presentation, order processing and billing services. Search engines and Web crawlers are examples of still other applications ideally suited to SHV servers.

A Growing Suite of Server Standards

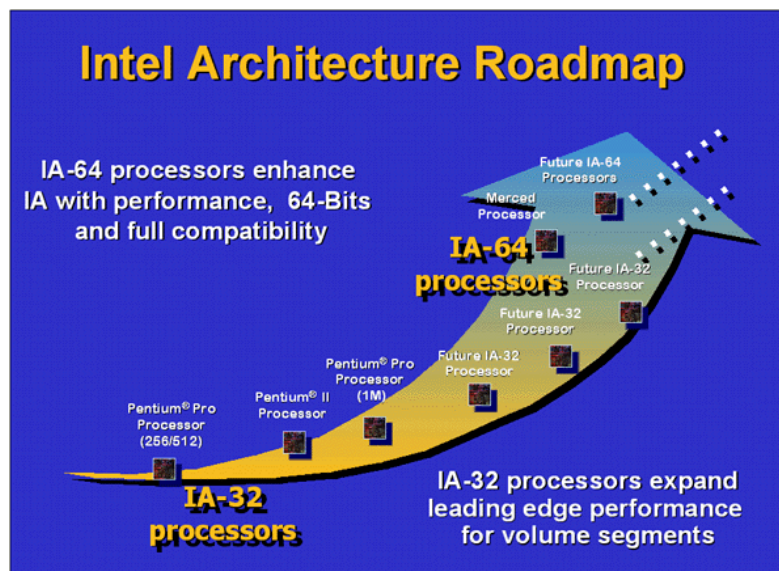
Many of the standards embodied in volume servers are well established in the PC industry. The most familiar example is PCI, the peripheral component interface standard, which is today's leading server I/O bus. Other familiar examples are high-volume DRAM and, of course, Intel Architecture microprocessors. Where SHV server standards are departing from their PC origins is typically in terms of scope and scale, be it processing, memory, or I/O. And increasingly, SHV server standards are attacking areas such as clustering and manageability which are unique to server applications. Let's look at what's happening now and what's on the horizon in terms of volume server standards and technology.



Processor Standards: The IA-32 and IA-64™ Processor Families

As we enter 1998, Intel's 32-bit architecture (IA-32) processor roadmap continues to show performance scaling right in line with **Moore's Law** (<http://developer.intel.com/solutions/archive/issue2/feature.htm>). The introduction of the Pentium® II processor on Intel's newest 0.25 micron process will occur in the first half of 1998. Processor speeds are expected to reach 450 MHz before the end of 1998. The higher clock speeds, enhanced Dual Independent Bus (DIB) architecture, and larger L1 caches all contribute to a rock solid IA-32 processor roadmap, ideally suited to entry-level and other cost-sensitive SHV server products.

Also on the 1998 IA-32 processor product horizon is the Slot 2 implementation of the 0.25 micron Pentium II processor. This new CPU/cache package combination will enable full-speed L2 cache buses, 100 MHz system bus frequencies and glueless 2-, 4- and 8-way symmetric multiprocessor (SMP) servers. It is important to note that Slot 2 does not replace Slot 1 packaging, but instead implements a new S.E.C. (single-edge cartridge) form factor specifically engineered for mid-range and high-end servers and workstations



Building on the breadth and depth of the IA-32 processor family, Intel's 64-bit IA-64™ processor family will change the way the industry thinks about—and uses—IA-based SHV servers.

Based on **Explicitly Parallel Instruction Computing (EPIC) technology**

(<http://www.intel.com/pressroom/archive/backgrnd/sp101497.HTM>), jointly developed by Intel and Hewlett-Packard*, IA-64 processor performance will quickly outpace advancements in RISC processor performance for both servers and workstations, while delivering full IA-32 processor compatibility. Virtually all of the leading server and workstation suppliers have announced their plans to incorporate IA-64 processors in their next generation servers and workstations.

Intel's first IA-64 processor, code-named the Merced™ processor, will be built on Intel's next generation 0.18 micron CMOS technology. The Merced processor program, now on-track for a 1999 launch, will include not only processors and chip sets, but an extensive software solution stack including a variety of standard operating systems and key applications.

SHV Server Chip Sets

Intel is investigating new 4-way SHV server chip set technology to support the new Slot 2 Pentium II microprocessors. This new architecture will isolate the processors from I/O activity by providing multiple paths for I/O data to move in and out of memory without arbitrating for the front-side system bus. Overall memory bandwidth will also be boosted to support the faster front side bus performance at 100 MHz. For greater overall I/O bandwidth and expandability, a new generation of PCI bridges will be required to support multiple PCI I/O buses.

With the acquisition of Corollary*, Intel announced its intention of bringing 8-way SMP designs under the SHV umbrella. The ProFusion* architecture takes the glueless 4-way SMP design and cleverly doubles the processor count while retaining much of the same overall simplicity. The ProFusion chip set limits a single front side bus to just four CPUs. Two full-speed front side buses support the total of eight Pentium II CPUs, while a separate full-speed front side bus is dedicated to I/O. This combination is expected to deliver the best 8-way performance scaling to date and still be among the most cost effective of the various 8-way designs.

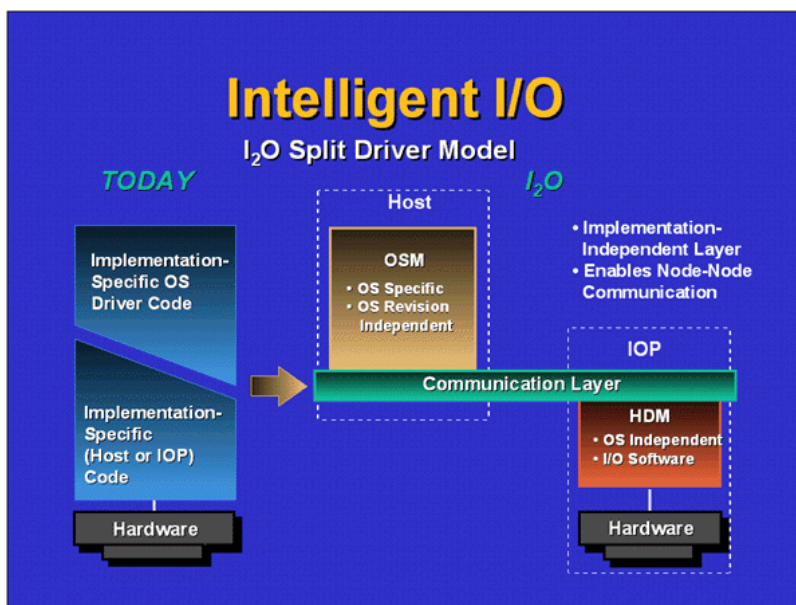
Time for a Change: the new DRAM Standard

The address-multiplexed DRAM has been a staple of the computer industry for so long it is hard to imagine anything coming along to replace it, but that time has come. Intel has already announced that its next generation desktop microprocessors and chip sets will be designed to work with a new DRAM design called Rambus* DRAM Direct or RDRAM-D. Representing the second generation of Rambus memory designs, the new part offers very high memory bandwidth, low parts count, and greatly improved latency. While RDRAM-D is well-suited to the PC environment with its relatively small memory requirement, there is still work to be done to make it viable in servers. Given the potential cost penalty of using lower-volume, non-desktop DRAM designs for SHV servers, Intel has launched an intense effort to make RDRAM-D as attractive for servers as it is for PCs.

Server I/O Standards: Smarter, Faster, and Better

The original 32-bit PCI bus standard, first deployed in PCs, is today's workhorse volume server I/O bus. It is typical for servers to provide at least one, and more often two 32-bit PCI buses in a single system. Nonetheless, more single bus PCI I/O bandwidth is needed for the emerging Gigabit Ethernet adapters and Fiber Channel controllers, each of which can demand more than the effective 32-bit PCI bandwidth during a single burst transfer. The first step will be to double the PCI bandwidth by going from 32-bit to 64-bit transfers and then to double it again by moving the PCI bus clock from 33 MHz to 66 MHz. Both of these advancements are already defined by the latest revisions to the PCI bus specification. The next round of server chip sets for both 4-way and 8-way SMP systems will support various combinations of multiple 32-bit and 64-bit PCI buses.

While more and faster PCI buses addresses the immediate need for increased I/O bandwidth, system architects have been looking at ways to give SHV servers the same I/O capabilities found in traditional mainframe systems. The first of these is a standards effort known as the Intelligent Input/Output, or **I₂O initiative** (<http://developer.intel.com/solutions/tech/i20.htm>). Intended to offload low-level I/O processing to input/output processors (IOPs), I₂O standardizes a so-called split driver architecture for various classes of I/O devices including SCSI disks and Ethernet LANs. The high-level portion of the driver, called the OSM, runs on the server host, and communicates with each I/O adapter by passing well-defined commands in the form of messages. The low-level portion of the driver, called the HDM, runs on an IOP located either on the adapter card or on the server motherboard. The HDM processes the command messages from the host OSM and sets-up the DMA transfers to and from host memory. The first of I₂O-based storage adapters are coming to market in the first quarter of 1998 and I₂O-based LAN solutions are right behind them. Initial tests suggest that I₂O-based adapters should significantly offload the host CPUs and increase the scalability of the server I/O system.



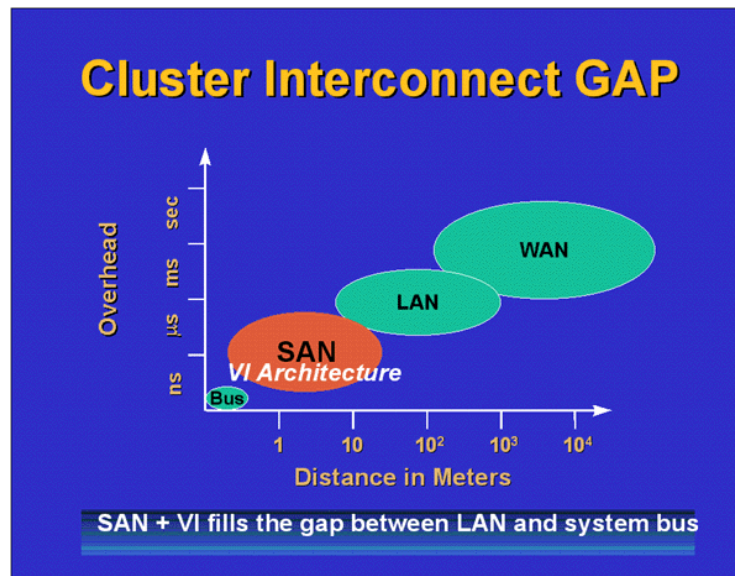
The next steps in the I₂O standard are also well underway. Revision 2.0 of the I₂O specification, scheduled for release in the first half of 1998, will add architectural support for remote I/O adapters attached to the host via a system area network (SAN), along with a number of other new features.

Looking beyond both the PCI and I₂O standards, work is already underway on a next generation I/O architecture standard for SHV servers. Combining advancements in high-speed serial communication, SANs, and low-overhead message-passing, the future SHV server I/O subsystem will rival or even surpass mainframe I/O subsystems in performance, scalability and reliability.

SHV Clusters: Taking High Availability and Scalability out of the Glass House

Given the building block nature of the underlying technology, it is only natural that clusters of SHV servers be combined to form closely-coupled, but distributed systems to achieve higher availability and higher scalability. A number of companies have offered proprietary solutions of this sort for several years. Unfortunately, the non-standard nature of these solutions has limited the growth of the volume cluster market segment. Two developments, which took place during 1997, have the potential to rectify this situation and bring cluster technology to a broad range of server applications. The first of these developments was the release of Windows* NT Enterprise Edition by Microsoft*. For the first time, cluster support comes as part of a high-volume operating system product. While limited to 2-way availability clusters in its initial release, the Enterprise Edition of Windows NT promises to make both available and scalable cluster OS services widely available over the next several years.

The other major cluster development for SHV servers was the release of Revision 1.0 of the Virtual Interface Architecture specification. Promoted by Compaq*, Intel, and Microsoft, the **VI Architecture** (<http://developer.intel.com/solutions/tech/via.htm>) is an open specification for low-overhead message-passing within clusters of volume servers and workstations. While compatible with LAN technology, the benefits of VI architecture are fully realized in the newer SANs. The inherently lower overheads found in the SAN environment are fully exploited by hardware and software designed to be compliant with the VI architecture specification. By focusing the volume cluster hardware industry around a common message-passing standard, the VI architecture is expected to foster SAN competition, accelerate SAN innovation, and spur development of scalable applications, such as database systems and various types of Internet and Web services. The first VI-compliant hardware products are scheduled to reach the market in the first half of 1998, with others to follow later in the year and into 1999. Scalable database management systems will be the first VI-compliant software products, also expected to reach the market in 1998.



Wired for Management: Unifying Manageability from Clients to Servers

1997 saw the volume computer industry get serious about improving system manageability and lowering the total cost of ownership of desktop PCs, mobile PCs, and SHV servers for the enterprise.

Intel led the way with its broad-based **Wired for Management (WfM) Initiative**

(<http://developer.intel.com/solutions/tech/wfm.htm>). Revision 1.1a of the WfM Baseline Specification focuses on four main areas for server management: instrumentation interfaces, remote setup, remote wakeup, and power management.

Server instrumentation under WfM is based upon the Desktop Management Interface (DMI) and Simple Network Management Protocol (SNMP) specifications. The WfM Baseline makes remote setup a recommended feature for modern, manageable server platforms. Remote wakeup is an optional element of the specification. It allows a server system that has been powered down, perhaps as a cost or energy-saving measure, to be automatically powered back on remotely. Finally, power control is an increasingly important element for manageable servers, and the specification strongly recommends that all of the relevant components of a server be compliant with the Advanced Configuration Power Interface (ACPI) power-management specification.

The newest SHV server management initiative, soon to be announced by Intel and leading server suppliers, moves deeper into standardizing the key management elements of server hardware architecture. More specifically, it defines a common interface and bus protocol for **server platform management hardware** (<http://developer.intel.com/solutions/issue/stories/top3.htm>). The fully WfM compliant standard ensures easy access to server platform management information. It is both scalable from entry-level to high-end servers and expandable from single to multiple systems. Perhaps most importantly, compliant hardware elements are easily portable to new server designs. Following an open industry comment period to begin in the first quarter of 1998, Intel and other server vendors intend to announce Revision 1.0 of this server platform management specification in the second quarter of 1998.

Doing the Obvious: System Infrastructure Standards for Volume Servers

Although it rarely draws the attention of a new microprocessor or a faster I/O bus, much of the price/performance advantage of volume desktop systems comes from the extensive standardization of the underlying electromechanical infrastructure. From motherboard designs, to power supplies, to sheet metal, manufacturers around the world compete to produce these key sub-assemblies literally by the millions. Recognizing that SHV servers lack a standard system infrastructure, Intel is getting ready to launch a groundbreaking initiative to standardize two high leverage elements of the **server system infrastructure (SSI)** (<http://developer.intel.com/solutions/issue/stories/top4.htm>): power supplies and the main electronics bay. The latter refers to the physical space allocated to the server motherboard, memory and I/O (for entry-level servers). The SSI specification is still in its initial draft form, but moving quickly. The early industry response has been positive and suggests that the effort will quickly expand into other aspects of the infrastructure.

Conclusion

Standards are the fuel of the virtuous economic cycle that has made and kept the personal computer as the most cost-effective computing platform for nearly two decades. A suite of standards, as complete and compelling as the one which exists for PCs, is now required to bring the full benefits of the virtuous cycle to volume servers. Intel is committed to working with the server industry to create this broad set of SHV server specifications: from the more mundane aspects of server system infrastructure, to leading edge IA-32 and IA-64 processors and chip sets, to the exciting future of scalable clusters and mainframe-class I/O subsystems.

About the Authors:

Justin Rattner is an Intel Fellow and Director of Intel's Server Architecture Laboratory. His current R&D activities focus on future generation IA-32 and IA-64 server technologies and standards.

Paul Close is Director of Platform Architecture within the Server Architecture lab. His focus is on IA server system architecture.

For More Information:

Don't miss the other **Server related top stories** in this month's *Server Focus Issue* of *Platform Solutions*. You will find articles on SSI, Server Platform Management Hardware, and I₂O technology, as well as the Feature Story by John Miner, Intel's Vice President and General Manager of the Enterprise Server Group.

(<http://developer.intel.com/solutions>)

To get more details around SHV server initiatives and technologies, and to stay on top of the latest news and information, please visit the **Server Platforms page** in *Platform Solutions* on a regular basis.

(<http://developer.intel.com/solutions/platfms/server.htm>)

For the latest news in Microprocessor technology, please visit the **Microprocessor technology page** in *Platform Solutions* every month. (<http://developer.intel.com/solutions/tech/micro.htm>)

For more information on Intel's Wired for Management (WfM) initiative, please visit the **WfM technology page** in *Platform Solutions*. (<http://developer.intel.com/solutions/tech/wfm.htm>)

Top Stories:

Pushing the Envelope of Platform Technology: The Intel Developer Forum

By Dan Russell
Director of Platform Marketing
Intel Corporation

The PC platform has achieved higher levels of performance, in higher product volumes than ever before. Ironically, by delivering unprecedented levels of price/performance, the PC industry will raise the bar even further in 1998.

It is an inescapable fact that PC users in all application segments are becoming more technically sophisticated. And they have learned through experience to expect more performance in volume products--and to expect this performance at lower relative price points. To meet these elevated customer expectations the industry is now required to push the envelope of PC platform technologies faster than ever before. Fortunately, the industry is well equipped to meet this challenge. Baseline specifications are now in place that will enable us to advance the state-of-technology of the PC platform through 1998 and beyond.

The Intel Developer Forum (IDF) is the essential means of moving "Beyond the Spec" to deliver a new generation of PC products that will meet today's heightened user expectations. The Feb '98 Intel Developer Forum is your opportunity to go "Beyond the Spec" for a detailed look at how new technologies are redefining the PC platform. Share the vision, as Intel and other PC industry leaders provide the implementation details for new platform technologies. Come away with all the tools and training you need to get products to market quickly.

IDF is Coming February 17. The Time to Register is Now

The **first IDF** (<http://developer.intel.com/solutions/archive/issue2/stories/top4.htm>), held in the fall of 1997, generated widespread positive feedback from developers and the technical press. Now that the demand for new technologies continues to grow, the second IDF will provide even more of the vital technical information and implementation details developers will need to bring products to market in 1998.

The opportunity is real, but time is growing short. Developers should make plans to attend now, and register for this significant event before space runs out. IDF will be held on February 17, 18 and 19 at the San Jose Convention Center, San Jose, CA, USA. Please visit the **Intel Developer Forum web site** (<http://developer.intel.com/design/idf>) for registration details.

Keynote Presentations

Each of the three days of IDF will feature a keynote presentation, outlining Intel's strategic vision of the trends, products, and technologies that will shape the evolution of PC platforms. Dr. Andrew Grove, Intel Chairman and CEO, will be presenting his vision of the changing PC marketplace. Following Dr. Grove, Dr. Albert Yu, Senior Vice President and General Manager of the Microprocessor Products Group, will be presenting future product roadmaps. On the third day Patrick Gelsinger, Vice President and General Manager of Intel's Business Platform Group, will present platform technology roadmaps.

What to expect at IDF

- **The Vision:** The Intel Developer Forum is the PC industry's premiere source for the hardware technologies driving the evolution of the PC platform through 1998 and beyond.
- **The Technologies:** Your opportunity to gain technical knowledge direct from Intel's technology experts, provided in 15 graduate-level technology tracks with more than 70 technical sessions.
- **The Tools:** Get the practical knowledge, the tools and the training you need to deliver products now. CDs containing actual performance validation and optimization tools, specifications, design guides, white papers, and more will be distributed during the conference.
- **Hands-On Labs:** In an effort to make the Feb'98 IDF even better we've added three different sets of hands-on labs. Labs include tutorials on manageability, desktop performance, and mobile design.
- **Demo Showcase:** See over fifty technology demonstrations by Intel and other leading companies at the February 17th evening reception. Talk personally with technology experts about their latest implementations.
- **Tech Talk:** Meet Intel's platform architects and technology experts one-on-one and meet with industry experts at the February 18th evening reception. Informal roundtables will discuss the hottest current topics facing the PC industry today.

IDF—Technical Solutions Straight from the Source

IDF demonstrates Intel's commitment to the PC industry by helping developers understand and implement the changing technologies that are driving the evolution of the PC platform. Advanced platform developers look to IDF for graduate-level training, one-on-one interaction with the experts and a chance to get an advantage in a rapidly-evolving market. Tips, tricks and the latest tools as well as unveilings of hot new technologies that are driving the hardware platform will be shown. IDF is the place to get it straight from the source.

About the Author:

Dan Russell is Director of Platform Marketing at Intel Corporation. He is responsible for PC platform strategy and technology initiatives.

Registration and Event Details:

For registration information and the latest details on the February IDF, please visit the **Intel Developer Forum Web site** (<http://developer.intel.com/design/idf/>).

IDF at a Glance:

Here is an overview of the technology tracks and labs covered at the February IDF. For details on the more than 70 sessions within the tracks, as well as information on the presenters, please visit the **IDF web site**.

IA-64 Architecture Innovation

This track provides a preview of some innovative architectural features of the next generation IA-64 instruction set. Through use of detailed examples, the discussion will provide an understanding of the key features, how they can be used effectively, and the resulting benefits.

High Performance Memory Implementations

PC main memory design is becoming increasingly important for the overall system performance. We will show you how main memory effects system performance. You will get an update of the Intel PC SDRAM specs, including the Registered DIMM spec and the PC SGRAM spec for graphics. To prepare you for the transition to Direct RDRAM in 1999, we will explain how the 1.6 GB/sec is achieved, and how to design your systems for Direct RDRAM. In addition we will provide you with an update on the status and plans of the DRAM industry.

Basic PC Design

This track investigates the cost reduction of a performance PC's building blocks. The building blocks include the processor, chip set, peripherals, motherboard, chassis, and power supply. Also included is a detailed description of the new Micro ATX chassis. This form factor enables a micro tower solution which will be demonstrated.

External Interconnect Technologies

Learn the latest in USB and 1394 technologies to enable you to design and productize volume PC platforms and peripherals. With USB, critical implementation areas, i.e. ease-of-use, bandwidth sharing and power management are discussed in depth. A focus area is platform level interactions between USB and other subsystems.

Also learn the tradeoffs with integrating 1394A and B capability in the PC, especially power distribution, management and isolation. Building on the USB experience, the key 1394 requirements in HW/SW building blocks, tools and interoperability are described.

Delivering Cost Effective, High Performance PCs

Today's personal computer market demands high performance solutions that are low cost and high volume. This track summarizes desktop performance trends and presents detailed solutions that meet cost and volume constraints. Attendees will receive advance details of processor options, AGP-4X, high speed clocking, extending ATX/NLX thermal and EMI limits, and sub-2.8V power delivery.

Next Generation Graphics

Graphics performance gains continue at a tremendous pace. This track will provide an overview of the Preliminary Draft of the AGP Interface Specification Rev. 2.0 covering new developments since the AGP Interface Specification Rev. 1.0. Sessions during the day will focus on an overview of AGP 2.0, including the motivation for Rev. 2.0 and the changes following Rev. 1.0; electrical considerations; technology capabilities and implementation alternatives; package modeling and requirements; and, board requirements for 4-layer and 6-layer boards.

Mobile Platform Technologies

This track covers several topics related to designing optimal mobile PCs in 1998. It will explain what to watch out for in designing a PC98 compliant mobile system. It will provide implementation details of mobile AGP, including thermals, clocks, EMI and layout issues and solutions. In addition, specifics of Intel's Mobile Power Initiative will be discussed, including the Mobile Power Guidelines, ACPI, advanced thermal designs, and other power management techniques.

Server Platform Technologies

This track will explore the specifics of advancing server technologies, and provide details for optimal design inclusion of emerging technologies into server platforms and subsystems. Key topics will include: VI Architecture implementation and performance; Intelligent I/O (I₂O[®]) architecture; server I/O subsystem performance; the Server System Infrastructure (SSI) specification; instrumenting and managing SHV servers and clusters of SHV servers, SHV server design guidelines, and designing for server performance in the horizontal computer industry.

Wired for Management Baseline Specification

This track will outline the evolution of the Wired for Management (WfM) Baseline specification. Sessions will provide an detailed architectural overview of the new elements of the Baseline and discuss the evolution from version 1.1a to 2.0. Included will be a description of the new and improved elements in WfM 2.0 and associated enabling tools and technologies for early adopters.

This session is an introduction to the WfM Baseline specification. It will set up the rest of the tracks which drill down into the specifics and will highlight the end customer benefits of the new technologies and how they fit in with the "big picture" of the WfM initiative.

Instantly Available PC Power Management

This track will discuss recent innovations/updates of Instantly Available PC power management (IAPCPM). Sessions will provide an architectural overview of IAPCPM and explain new requirements for the PC hardware (including 3.3Vaux support in PCI PM) and the power delivery system. The track will include a segment on communication subsystems in the IAPC (Modem and NIC) and will conclude with a discussion of recent implementation techniques developed in order to incorporate NLX and ATX form factors in the IAPCPM architecture

Understanding 3D Graphics and AGP Performance

Higher graphics performance are required to enable end users to run new applications with richer data and features on their PCs. This track will discuss objective measurements of application workload and 3D hardware capability expectation, and application and analysis of 3D graphics performance metrics and performance dependencies. AGP system integration and performance validation will also be discussed.

Workstation Platform Technologies

The track is a discussion of some key platform technologies and tools developed by Intel that can significantly benefit the workstation market. By taking advantage of these technologies, hardware and software vendors can produce higher-performance products targeted for the needs of this growing market. Topics include: the performance benefits of dual-processor systems, designing systems for the Deschutes (Slot 2) processor, using performance tools and libraries for workstation applications, and using AGP and USWC memory.

IPEAK Tools for Power Management and Mass Storage

Intel has developed a family of platform performance tuning and integration tools called Intel Performance Evaluation and Analysis Kit (IPEAK). In this track, we'll present training seminars on two IPEAK tools: Intel Power Management Analysis Tools (IPMAT) and storage toolkit. We'll cover all the features, functionality and applications for the tools. You'll learn how to analyze, compare and optimize the performance of storage subsystems, and how to use the tool for validation and set up automated testing for power management compliance standards.

Intel Product Integration

As part of Intel's continued commitment to quality product and value-added services, the Manufacturing Advantage (MAS) program has now been expanded to make it easier for Intel's customers to use and ramp Intel products in their production by providing technical information, practical assistance, and problem solving expertise on many new products and technologies (ex. SECC Retention Mechanism)

Host-based Interactive DVD

Intel is the industry leader in bringing DVD to the PC. In this track, Intel experts will give an insight in the Host-based Interactive DVD technology. The track will provide Intel's vision on how visually rich and interactive experience would move PCs to the family room. It will highlight the arrival of host-based interactive DVD as a free feature on Pentium®II platforms. The sessions are designed to teach key enabling features of system architecture, software architecture and MMX™ technology software optimization. The sessions will elaborate on system requirements such as Pentium II platform with MMX technology, AGP graphics controller, etc. An update on status of compelling interactive content will be given. Also, all the related legal issues such as license requirements, license terms, content protection, etc. will be covered in detail.

Wired for Management Lab

Intended as a hands-on implementation focused introduction to the Baseline specification (release 1.1a). Focus of the lab will be to demonstrate that the underlying technologies for WfM exist and are implementable now. Participants will actually build a WfM compliant system from supplied components and tools and techniques. The class will also serve as an introduction to the wealth of enabling material available from Intel -- from development tools to design guides to compliance self-test tools.

Mobile Platforms Lab

The Mobile Platforms Lab presents technology and tools for designing Mobile PCs with reduced power consumption, improved manageability, and lower total cost of ownership. The Mobile Power Tools Workshop will explain, demonstrate, and offer an opportunity for hands-on experience with three tools designed to reveal the power consumption of components, systems, and software. The Mobile Manageability Workshop will enable the development of manageability objects for mobile platforms.

Common Ground for Server Management Hardware

by Kevin Soelberg
Marketing Director, High-End Server Division
Intel Corporation, Enterprise Server Group

While an abundance of server management software standards already exist in the industry, no standards to date have focused on server platform management hardware. A new specification, soon to be announced by Intel and leading server system vendors, defines a common interface and bus protocol for platform management hardware which lowers total cost of ownership (TCO) by improving server platform management functionality and compatibility.

Good overall server management technology is key to reducing TCO for large enterprises today by increasing platform availability, serviceability and reliability. And the foundation for strong overall server management lies in platform instrumentation namely, the wide range of sensors for monitoring temperature, voltage, events and messages that encompass the hardware portion of server management solutions.

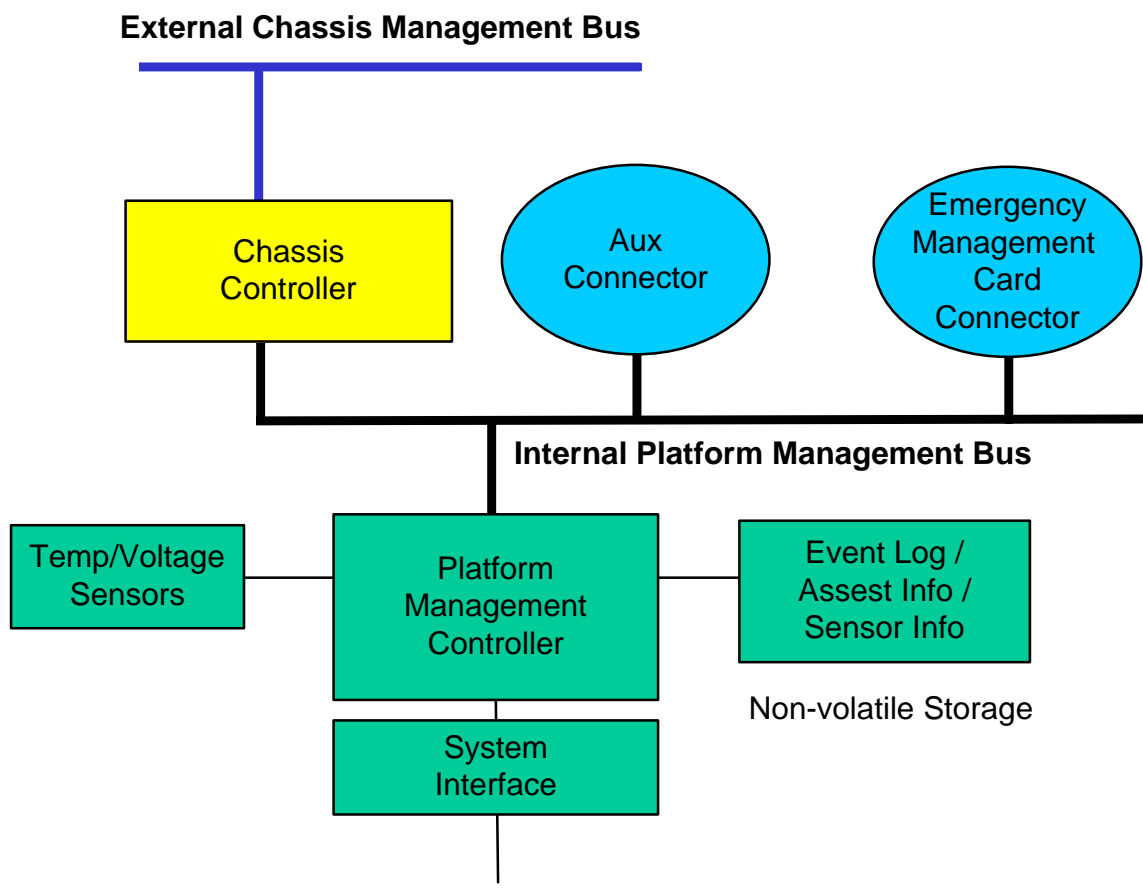
While all server OEMs offer basic platform instrumentation, most of their solutions are proprietary and limited in their scalability, extensibility, and portability, making it difficult to maintain continuity from one generation of server to the next. With the proliferation of mission critical multi-server environments consisting of complex configurations such as server clusters and rack mount systems, the need for interoperable, standards-based platform hardware management solutions is greater than ever.

Unfortunately, although server management software standards such as DMI, SNMP, CIM and WMI exist in abundance, there are no standards in place today that address the hardware portion of the equation.

An Open Specification for Platform Instrumentation

As part of an ongoing commitment to create open specifications that enable the adoption of new technologies, Intel and leading server systems vendors are currently working on a first version (v0.9) of a specification which will support the **Wired for Management (WfM) initiative** (<http://developer.intel.com/solutions/tech/wfm.htm>). WfM is part of a broad-based industry effort, lead by Intel, to integrate all of the pieces of the enterprise architecture, 'end-to-end' in a way that provides greater control and manageability for IT professionals while reducing total cost of ownership for large organizations.

Server Platform Management Hardware Architecture



Specification's Benefits

The specification will provide three key benefits to the industry:

- Common access to platform management information. The interfaces are designed such that the information can be easily accessed by management software from the system side as well as by an I²C¹-based management bus. The bus operates autonomously so critical sensors and events can be monitored and logged even if the processor goes down and system management software is not available. The bus also enables devices such as Emergency Management Cards to easily access platform management information.
- Robust and flexible solution which supports a wide range of servers and configurations. The specification is scalable from entry-level to high-end servers, and expandable from single to multiple systems. This provides support for a wide range of sensors, events, and messages across all segments of the server market. In addition, the internal management bus can be extended externally to the chassis to manage multiple servers or peripheral chassis, containing components such as RAID drives or power supplies, through a dedicated "out-of-band" connection. The external bus

¹ I²C is an industry-standard low-speed bus that was originally defined by Phillips electronics for use in consumer electronics devices. It is now widely used in server systems as the connection mechanism between management sensors and their associated controllers. The proposed specification provides a standard interface for that connection.

enables a server to be managed by another connected server even if it has no system management software or the processor is down.

- Efficient porting to new server designs. The specification interface decouples platform management hardware from server management software allowing hardware advancements to be implemented without impacting server management software. This architecture enables OEMs to quickly develop differentiated solutions that can be brought to market very quickly. The specification also facilitates the development of cross-platform management applications.

Industry Involvement

To ensure the participation of the industry in developing the new specification, Intel and leading server systems vendors will soon make the v0.9 specs available on the web for industry review and feedback. Following industry input, Intel and leading server system vendors plan to release version 1.0 of the specification by the end of Q2, 1998. A press announcement will be released soon detailing the companies involved as well as more information around the specification. Intel's Server Management Architects also plan to discuss the specification at the February **Intel Developer Forum (IDF)** (<http://developer.intel.com/design/idf>). So if you're interested in more details you should register to attend today.

About the Author:

Kevin Soelberg is the Marketing Director of Intel's High-End Server Division in the Enterprise Server Group. He is responsible for all of Intel's marketing efforts related to high-end servers and server management initiatives.

For More Information:

To stay tuned to the status of the new specification, please visit the new **Server Platform Management Hardware technology page** in *Platform Solutions*. This page will be updated with all the new information around this new specification on a monthly basis.
(<http://developer.intel.com/solutions/tech/platmgmt.htm>)

Defining a Specification for Server System Infrastructure (SSI)

by Abhi Talwalkar
General Manager, Entry/Mid-Range Server Division
Intel Corporation, Enterprise Server Group

The lack of a standard specification for common server system elements requires server system vendors to frequently redesign the basic infrastructure of their server products—a proprietary, expensive and time-consuming process. Intel is working with leading server OEMs and industry suppliers to help remedy the situation.

Increases in microprocessor performance and functionality drive corresponding increases in memory, I/O, storage and power and thermal requirements for servers based on the Intel Architecture. Due to the lack of established open industry specifications and standards, however, server vendors typically must redesign such common server system elements as the power supply and chassis with each succeeding generation of system products.

Unfortunately, proprietary designs for these common elements add little value to end-user solutions. Due to lower volumes and manufacturing inefficiencies, frequently redesigned server elements generally fail to reduce overall costs. In addition, proprietary solutions limit the available supplier base and hamper supplier-driven product innovation. For server system vendors and their suppliers, the server element redesign process is expensive and time consuming, leading to longer product development and time-to-market cycles.

Taking Initiative

In light of these issues, Intel is cooperating with leading server vendors and industry suppliers to lead the way in establishing an initiative to define the common elements of today's and tomorrow's server system infrastructures. Called the SSI initiative, the effort is designed to help the industry develop a common set of server element specifications, and thus lay the groundwork for future growth in the server market. The initiative is similar to such desktop PC efforts as ATX and NLX in that it is working to define common packaging elements for the server market. The SSI initiative will:

- Extend the longevity of server packaging chassis into future generations
- Reduce OEM and IHV R&D expenses related to system integration
- Provide a foundation for interchangeable server subsystems
- Broaden the supply base for server system elements, leading to reduced costs
- Continue to advance the award-winning, price/performance leadership position of Intel Architecture-based servers

Keeping Server System Elements at Bay

The SSI initiative's goal is to deliver a set of specifications covering two primary server elements: power supplies and electronics bays. The latter term refers to the physical space in the server chassis allotted to the motherboard—including the microprocessor, memory, I/O and related chip sets for entry-level servers (in high-end servers, I/O functions are typically handled off the system motherboard).

[insert electronics bay graphic here]

For power supplies, the SSI specification will address such factors as physical dimensions, wattage range and electromechanical interface parameters. In the case of electronics bays, the specification will cover such parameters as size and space, cooling functions, and even physical mounting considerations. The SSI initiative calls for developing a set of specifications that address all segments of the server market, from entry-level products on up through advanced enterprise servers.

First Steps

In the near term, Intel will soon deliver an initial open SSI specification so that industry reviewers can begin the process of driving toward a common standard. Intel and lead reviewers from the industry will provide a working draft of the specification, along with related design recommendations, at the **Intel Developers' Forum (IDF)** (<http://developer.intel.com/design/idf>) February 17–19. In addition, Intel is committed to providing engineering support, technical marketing resources and compliance test tools to help the SSI initiative resolve the need for a common industry server systems infrastructure.

About the Author:

Abhi Talwalkar is the General Manager of the Entry/Mid-Range Server Division (EMSD) in Intel's Enterprise Server Group. He is responsible for planning, developing and delivering industry-leading entry-level and mid-range server boards, systems and technologies based on the Intel Architecture.

For more information:

To stay informed of the status of this new initiative, please visit the new **Server System Infrastructure technology page** in *Platform Solutions*. This page will be updated with all the new information around this initiative on a monthly basis. (<http://developer.intel.com/solutions/tech/ssi.htm>)

Increasing competitive advantage with I₂O[®] technology

by Kirill Tatarinov
Vice President, Application Management Products
BMC Software, Inc.

The I₂O[®] (Intelligent Input Output) architecture is an open specification designed to improve the scalability and I/O throughput of servers by off-loading I/O interrupts from the main CPU to dedicated I/O processors, such as the Intel i960[®] RD I/O Processor. In addition, the I₂O specification enables vendors to create drivers that are portable across multiple Network Operating Systems and host platforms. Prior to the development of the I₂O specification, managing I/O devices for optimal performance and availability proved to be a difficult challenge. BMC Software has met this challenge head-on and is the first software company to provide users with access to information available via the I₂O architecture as well as the ability to integrate the data and use it in a wider application management perspective.

In recent focus group sessions conducted by BMC Software, the majority of end users in the groups reacted positively when questioned about purchasing PATROL[®] Application Management functionality with solutions featuring I₂O technology. Exactly 90% of those in the focus group indicated they would pay between \$200 and \$500 extra for a \$10,000 server if it were bundled with BMC Software's I₂O Application Management Toolkit. In addition, 70% consider the inclusion of an I₂O technology-based management application to be a key purchase criteria for server platforms.

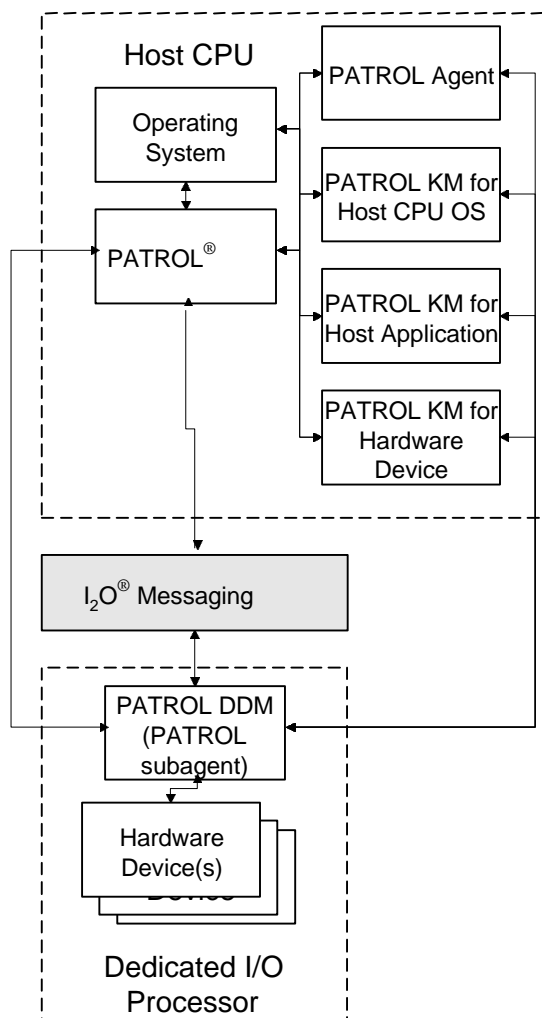
I₂O Architecture and PATROL

The PATROL Management Suite and the I₂O Application Management Toolkit products from BMC Software bring application and device management functionality to servers that support the I₂O architecture. By managing I/O events and letting users correlate them with event information from applications, databases, Internet technologies, middleware and other resources, PATROL provides a powerful management solution for server platforms featuring I₂O technology.

The I₂O Application Management Toolkit, available through the PATROL Developer Network (PDN[™]), provides a ready-to-run management application that is easily integrated and bundled with I/O peripherals featuring I₂O technology. By bundling the toolkit, server OEMs as well as network and disk controller vendors who offer solutions based on I₂O technology can bring users the added advantages of monitoring I/O events and providing alarms when thresholds are exceeded. With a PATROL solution for I/O peripherals with I₂O technology, hardware vendors can provide a solution that allows MIS managers to monitor:

- All devices based on the I₂O architecture in a network
- All standard parameters
- All optional parameters
- Unique combined parameters, including cache hit rate, defrag requirements, etc.
- Unique I/O processor utilization monitoring

The figure below graphically illustrates how I/O processing, monitoring, and management is achieved with PATROL under the I₂O architecture.



Glossary of I₂O architecture terms:

- OSM—OS Service Module**
 The OSM handles the communication between the host CPU operating system and the I₂O Messaging Layer. The OSM is unique for each operating system.
- DDM—Device Driver Module**
 The DDM handles the communication between the peripheral device and the I₂O Messaging Layer. The DDM is unique for each device; however, unlike a traditional device driver, only one DDM needs to be written because it is independent of the host CPU operating system.
- I₂O Messaging Layer**
 The I₂O Messaging Layer handles communication between the OSM and DDM using a specific protocol. The I₂O Messaging Layer does away with the requirement for multiple drivers for the same device.

The PATROL software management architecture incorporates an Agent/Knowledge Module/Console model. The Agent resides at the operating system level and collects available data. Knowledge Modules (KMs) possess extensive knowledge of and monitor specific operating systems (NT, UNIX*, etc.), databases, middleware, and applications. The agent passes information to the KM, which then evaluates it and determines whether it is within safe operating parameters. KMs are designed with significant proactive response to potential problem situations thus making management of the overall system simpler and less expensive. Administrators can view the information from managed applications or devices with the console provided by PATROL. If desired, PATROLVIEW™ provides the option of integrating with other popular Framework consoles such as CA Unicenter TNG*, IBM TME 10*, HP Openview* and Tivoli TME*, enabling administrators to use a single console to view enterprise-wide management information.

The PATROL Agent/KM/Console architecture monitors system I/O by utilizing a “subagent” in the form of a DDM. This DDM executes on Intel’s i960 I/O processor and communicates status information via the OSM to the standard operating system level PATROL agent. Applications can be written specifically for I₂O technology-based devices, or the data accumulated from the I/O device can be incorporated into other higher level KMs. The access to lower level I/O data will allow KMs to include detailed monitoring of the I/O subsystem, allowing for greater overall optimization of the system for the particular application.

Benefits of a PATROL enabled I₂O Solution

Integrating PATROL Application Management capabilities into an I/O peripheral or server platform featuring I₂O technology provides significant benefits for end users, resulting in a competitive advantage for the supplier.

- **Built-in management abilities**—The toolkit provides a ready-to-run management system for monitoring I/O processing information.
- **Faster time to market**—By bundling the ready-to-run toolkit, vendors do not have to include management software in their development schedule, resulting in faster time to market and reduced development costs.
- **Integration into any management console**—Both the I/O hardware and applications can be monitored and managed from a central console. This console can be the one provided with the I₂O Application Management Toolkit, or it can be another management console integrated with PATROL with the OEM Console Integration Toolkit.
- **Maintain top performance**—Critical performance metrics related to disk fragmentation, cache utilization and packet activity enable users to maintain peak performance of databases, Internet servers and other applications.
- **Flexible and extendible architecture**—OEMs and IHVs who implement I₂O technology will be able to develop PATROL Knowledge Modules to manage parameters specific to a particular device, leading to better managed systems and increased product differentiation.

The future of PATROL and the I₂O architecture

The next wave of I/O capabilities is already on the horizon. Expanded connection and clustering options, peer-to-peer communication of peripheral devices, and fault isolation and management are exciting new areas of the I₂O specification.

As a Contributing Member of the **I₂O Special Interest Group** (<http://www.i2osig.org>), and by working closely with Intel, BMC Software has enabled PATROL to take advantage of information now available at the I/O hardware level. The I₂O Application Management Toolkit provides a ready-to-run solution that is easily bundled with an IHV's product and can provide meaningful differentiation from products that do not include this capability.

About the Author:

Kirill Tatarinov is the vice president of application management products responsible for the development of more than 160 computer software solutions that improve the management of business-critical applications and data, as well as optimize the performance of that critical data in complex computing environments.

For More Information:

IHVs interested in enabling their product with I₂O technology and PATROL should look on the **Patrol Developer Network** (<http://www.bmc.com/developers>) section of the BMC Software Web site. Additional information is also available describing I₂O (<http://www.bmc.com/products/i2o/>).

For additional information on Intel's I/O processors, please see **Intel's I₂O technology web site**. (<http://developer.intel.com/design/iio>)

More information regarding I₂O technology implementation in servers can be obtained at **Intel's I₂O technology web site for Servers** (<http://www.intel.com/procs/servers/i2otech/index.htm>). A new **Executive White Paper** published by the Aberdeen Group is also available. (<http://www.intel.com/procs/servers/press/aberdeen/body.htm>)

To stay on top of the latest I₂O technology news, please visit the **I₂O technology page** in *Platform Solutions* on a regular basis. (<http://developer.intel.com/solutions/tech/i20.htm>)

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Q&A on SHV Servers with Intel's Director of Server Platform Marketing

Mitch Shults
Director of Platform Marketing
Intel Corporation, Enterprise Server Group

Q1. What are SHV servers and why are they important to the computing industry?

Standard high-volume (SHV) servers are servers based on Intel microprocessors and built from high-volume industry-standards based building blocks. They deliver equivalent processing power, capability and a lot more flexibility than proprietary RISC-based servers that cost significantly more to acquire and maintain. Today, SHV servers are *purpose-built* from the ground up with more and more platform building blocks that meet special requirements for scalability, reliability, availability, serviceability and manageability to handle the vast array of computing challenges that businesses and enterprise face in the era of the Internet. More and more businesses are moving their mission-critical applications to SHV servers for their compelling economic advantages.

Q2. Where and in what business applications are SHV servers used today?

SHV servers are found *everywhere* in business today, hosting mission-critical databases, running manufacturing operations, order processing systems, enterprise financial systems, as well as everyday productivity applications like word processing and spreadsheets when run in multi-user mode on a shared server. SHV servers are by nature the most cost-effective means for departmental-level, enterprise-level and small business applications. The SHV server market segment is expanding at the rate of 40 to 60% a year today. This growth is due to the increased use of the Internet and electronic mail, the rising popularity of E-business, bigger databases, rising transaction volume, more users and simply the increasing competitiveness of global business today.

Q3. What is this *economics of volume* model that is driving the evolution of SHV servers?

SHV servers are following much the same volume economic model that PCs have followed for the past 20 years. Powerful Intel microprocessors manufactured in the millions combined with market-driven industry platform standards are enabling faster development of high-volume, low-cost servers. Cost-effective server solutions become available to more users, attracting additional volume and thus more vendors. Vendors compete to offer greater value, spurring greater innovation at a more efficient pace within a framework of common industry standards. More innovation means more value for users, who buy more servers, and the cycle repeats itself.

Q4. What is Intel's role in SHV servers?

Intel contributes to the advancement of SHV servers in various technology-driving, industry-leading ways. First, Intel designs and builds microprocessors for servers in virtually any level of client/server computing for business. Intel's processors and chipsets, with its ever-expanding capabilities in symmetric multiprocessing (SMP) and L2 cache technologies, are the primary building blocks for current and future generations of SHV servers that will soon be capable of providing "mainframe-class" (and greater) levels of processing power and availability. But to achieve their full potential, SHV servers need equally powerful I/O subsystems, the ability to be easily integrated into clusters, improved manageability, and still greater standardization. Intel is heavily involved with the rest of the industry—in both hardware and software sectors—to develop open specifications around critical areas of the server platform, thus furthering the growth of the server market to the benefit of both systems manufacturers, IHVs and end users alike.

Q5. Where can I get more information on SHV servers?

For more information on SHV server platform technologies and initiatives that Intel is leading, visit the **Server Platforms technology page in *Platform Solutions*** (<http://developer.intel.com/solutions/platfms/server.htm>). You will find an SHV server overview, as well as detailed pages on the Virtual Interface architecture for clustering, I₂O[®] technology for I/O processing performance, Server Platform Management Hardware for manageability and TCO reduction, and the new Server System Infrastructure initiative for common server system and chassis elements. Stay tuned to these *Platform Solutions* pages as they will be updated with the latest news and technology information on at least a monthly basis.

For server system developers and IHVs interested in more detailed implementation information on SHV server initiatives and technologies, the **Intel Developer Forum (IDF) coming on February 17th** (<http://developer.intel.com/design/idf>) is the place to go to meet up with Intel's top server architects as well as other industry leaders. IDF is a perfect example of Intel's efforts to work with the industry to go "beyond the spec" to accelerate new technology adoption and speed up new product development.

About the Author

Mitch Shults is Director of Platform Marketing in Intel's Enterprise Server Group. He is responsible for driving SHV server platform technology strategies and adoption within Intel and the server industry.

Platforms:

Business Platforms

What's New

- Intel and **PLATINUM technology** Team to Advance Desktop and Systems Management, Reducing Total Cost of Computing
(<http://www.intel.com/pressroom/archive/releases/LD123097.HTM>)
- Intel Developing Guidelines For **Lean Client And Network Server** To Support Variety Of Operating Environments. New End-to-End Intel Platform Will Expand Range of Business Computing Systems.
(<http://www.intel.com/pressroom/archive/releases/LC120397.HTM>)
- Intel has updated the **Wired for Management ToolKit** with latest WfM Building Blocks including a New WfM Design Guide to help Developers implement WfM Capabilities.
(<http://developer.intel.com/ial/wfm/>)
- Intel Architecture Puts **Java* to Work**.
(<http://www.intel.com/businesscomputing/archive/tech3.htm>)

Overview

The proliferation of hardware and software choices, and the explosion of the Internet and Intranet have made the business computing environment increasingly complex and expensive to deploy and manage. Intel is continuing to bring greater performance and capability to the standard business desktop PC, while at the same time increasing its efforts to make it easier to deploy and control.

With the introduction of the Pentium® II processor Intel has combined the power and capabilities of the Pentium® Pro processor with the multimedia and communications capabilities of MMX™ technology. Along with platform technologies like Accelerated Graphics Port (AGP), the standard business desktop now has the **visual computing** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>) capabilities of PC imaging, 3D graphics, and enhanced video processing that will take business computing to the next level and change the way businesses work with each other and with consumers.

Intel is now working with the industry on technologies that reduce the total cost of ownership and make PC's inherently easier to manage. The Wired for Management (WfM) initiative and Network PC (Net PC) platform are two examples of the tremendous progress made to enable greater control and lower Total Cost of Ownership (TCO).

Wired for Management

Intel's Wired for Management (WfM) initiative is part of a broad-based industry effort to reduce the costs of business computing without compromising compatibility or performance. The initiative includes new hardware and software products to help OEMs and others implement WfM capabilities, alliances with other industry leaders, education and development programs, and Intel-led industry efforts aimed at developing widely accepted manageability standards. Most importantly, the WfM initiative targets real reductions in support costs, the most expensive element of business computing.

The WfM Baseline Specification establishes a minimum set of management capabilities such as remote configuration and installation of operating systems and software applications, remote system inventory and monitoring, and after-hours maintenance. OEMs can build further capabilities on this baseline to deliver even more value to their customers.

Network PC (Net PC)

The Network PC, or Net PC, was born out of Intel's WfM initiative to reduce TCO and increase control without sacrificing necessary performance. The Net PC introduces a new category of business PC designed from the ground up to be centrally managed, while simultaneously delivering the power and versatility of a traditional business desktop computer. The benefits of the Net PC include remote system configuration over the network, automated distribution of software, simplified remote diagnosis and maintenance, asset management support and a sealed chassis. The built-in manageability features and locked chassis of the Net PC give IT (Information Technology) support staff a known entity, while at the same time locking systems to reduce unauthorized or unplanned changes in the client.

Wired for Management

What's New:

- Visit the **updated Wired for Management Baseline developers website** (<http://developer.intel.com/ial/wfm/>) for great new content including:
 - Intel DMI Explorer (DMI 2.0 Browser)
 - New DMTF DMI 2.0 conformance guidelines and testing tools (DCTS and COMPCHK2)
 - Updated PXE PDK (version 2.0)
 - New LANDesk® Client Manager SDK Mobile Upgrade Kit (LDCMMKIT)
 - Newly designed Wired for Management Design Guide
 - Updated WfM Baseline specification FAQ now available
- Intel and **PLATINUM technology** Team to Advance Desktop and Systems Management, Reducing Total Cost of Computing (<http://www.intel.com/pressroom/archive/releases/LD123097.HTM>)
- **Common Ground for Server Management Hardware**; Read the Top Story from Intel's Marketing Directory for High-End Servers, Kevin Soelberg (<http://developer.intel.com/solutions/issue/stories/top3.htm>)
- Intel Developing Guidelines for **Lean Client and Network Server** to support Variety of Operating Environments. New End to End Intel Platform Will Expand Range of Business Computing Systems. (<http://www.intel.com/pressroom/archive/releases/LC120397.HTM>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

"Manageability" is a **BIG** subject and the focus of several industry-wide initiatives. Intel's Wired for Management (WfM) initiative seeks to raise the level of management capabilities for mobile, desktop, and server platforms. The complementary Zero Administration for Windows* initiative from Microsoft* seeks to create more manageable operating systems and applications. The collective goal of these initiatives is to help plan, deploy, proactively maintain, and centrally control a distributed computing environment, in order to reduce the overall cost of owning and managing computers in the enterprise.

The WfM Baseline describes a consistent set of management capabilities which defines the minimum functions delivered in a target platform. These include requirements for instrumentation, remote wake-up, power management, and service boot capability. Along with the WfM Baseline specification, Intel has produced a set of development tools designed to ease deployment of these capabilities. These include the Intel DMI 2.0 Service Provider SDK, the Managed Objects Toolkit for rapidly developing management applications, the Mobile Component Instrumentation SDK for laptops, and the DMI SDK for Servers. Intel has also made available a WfM Design Guide showing the "how-to" details on implementing the WfM capabilities.

Benefits to Users:

The benefits of WfM Baseline-compliant systems are clear. It enables centralized system management: inventory, fix/repair, configuration and diagnostics, and provides for off-hours maintenance to minimize downtime. Picture a user who's having a problem with a built-in fax program and calls the company support hotline. The user continues using the system while a support technician remotely views the user's configuration and discovers that some files are mismatched to the hardware. The technician makes the needed changes and updates the correct files, all in the background, while the user continues working. Another common scenario is where the IT administrator updates to the latest version of the office productivity application suite automatically during the middle of the night without any user intervention.

Benefits to Manufacturers:

The WfM Baseline is easy for OEMs and developers to adopt and deploy and is based on industry standard management technology. DMI 2.0, for example, is a non-proprietary interface that is easy for vendors to adopt. In addition, DMI is independent of any specific operating system, hardware platform or management protocol. The interface is scalable to accommodate a wide range of products and mappable to existing management and remoting protocols.

Intel's Wired for Management ToolKit makes it easy for OEMs, IHVs, and ISVs to adopt and deliver management capabilities. The tools encourage the addition of value-added features on top of the WfM Baseline within its open-specification structure. The Baseline also provides a consistent target for applications developers including enterprise-wide management solutions.

Industry Status:

Since its initial release in April 1997, the WfM Baseline specification and its companion, the Network PC (Net PC) specification, have received wide industry support from a variety of key industry players. For more information on **supporting companies** see:

<http://www.intel.com/pressroom/archive/releases/nw31297b.HTM>

For Mobile, visit <http://www.intel.com/pressroom/archive/releases/NW060297.HTM>,

For Server, visit <http://www.intel.com/pressroom/archive/releases/wm063097.htm>

Evidence of the widespread momentum for the WfM initiative was demonstrated at the second Intel WfM interoperability workshop on September 26, 1997. Over 20 industry leaders tested the interoperability of manageable platforms and management software showing that Manageable PCs and Net PCs are here now and so are the tools to manage them (see the **press release** describing the event at <http://www.intel.com/pressroom/archive/releases/WM092997.HTM>).

Intel also provided detailed technical training and tools to further assist OEMs and IHVs in implementing the WfM Baseline specification at the Intel Developer Forum held on September 29, 1997. For more information on the **IDF WfM track** please go to (<http://developer.intel.com/ial/wfm/class/index.htm>).

Intel and Microsoft are working closely to align their management technologies. This is evident in the work that produced the Network PC (Net PC) specification, which was co-authored by Intel and Microsoft along with other industry partners. The two are continuing to assure that next generation Windows* operating systems are compatible with today's management technologies. This includes joint work on the *PC 98 System Design Guideline* released in September 1997, and the *Windows Hardware Instrumentation Implementation Guide* (WHIIG) expected to be available in early 1998.

Next Steps:

Specifications have been available for both the WfM Baseline and the Net PC since early 1997. Tools and training have been delivered to the industry. Two interoperability events have been held showing the momentum behind the WfM Baseline and the arrival of product building blocks. If you are currently designing systems or products for desktop PCs, mobile PCs, or servers, now is the time to design and

deliver WfM-based products so that businesses can take advantage of this technology to reduce total cost of ownership.

Visit the IDF web site (<http://developer.intel.com/design/idf/>) for event and registration information on the **next IDF February 17-19** in San Jose, CA. There will be two tracks focussed on Wired for Management-- one a hands-on lab session, the other a lecture-style track with an overview of today's management technology and a look ahead to the future of WfM. Additional WfM information will be covered in related tracks— **Instantly Available Power Management** (<http://developer.intel.com/solutions/tech/power.htm>) will cover power management implementation for Wired for Management and others will focus on developing manageability solutions for server and mobile platforms.

For More Information:

For more information on Mobile manageability, please visit the **Mobile PC Manageability site** (<http://www.intel.com/mobile/entrprse/managePC/index.htm>).

Helpful development tools may be downloaded from the **Wired for Management ToolKit** site for immediate deployment (<http://developer.intel.com/ial/wfm/>).

For more information on the **Network PC (NetPC)** visit Intel's Net PC web site at (<http://www.intel.com/businesscomputing/netpc/>).

For information on Intel's building blocks and **manageability products** and solutions visit (<http://www.intel.com/managedpc/product.htm>).

For more information on **DMI and the DMTF** visit the industry DMTF web site at (<http://www.dmtf.org>).

Intel's **Managed PC** web site contains information on WfM targeted at IT professionals (<http://www.intel.com/managedpc/index.htm>).

For information on Microsoft's **Zero Administration for Windows (ZAW)** initiative visit their web site at (<http://www.microsoft.com/windows/zaw/>).

Network PC (Net PC)

What's New:

- **New Net PC Case Studies** available for Download
Bose Corporation (<http://download here>)
Snow College (<http://download here>)
- Wired for Management **Specification 1.1a** Available
(<http://www.intel.com/managedpc/spec.htm>)
- **Other Net PC Case Studies** show advantages of Net PCs
(<http://www.intel.com/businesscomputing/netpc/>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The Network PC, or Net PC, is a new category of business PC intended to reduce ownership costs through its advanced management capabilities while delivering the power and versatility of traditional business PCs. Advanced system administration features, including remote configuration and repair and the ability to “wake up” systems for off-hours maintenance, give IT organizations greater centralized management capabilities while retaining existing LAN infrastructures. Hard disk drives give users the choice of running their Windows*-based business software and storing data locally or on servers.

The Network PC System Design Guidelines specify a number of advanced manageability features that enable easy, central administration. These include:

- **Remote boot.** The system can boot from a management server to receive downloads or updated operating system software or applications.
- **Remote wake-up (Wake-On-LAN* technology).** The system can be turned on remotely for after-hours maintenance.
- **DMI 2.0 support.** System elements using the Desktop Management Interface can be recognized and managed by industry-standard management software.
- **Instrumentation.** System elements such as the baseboard, processor, disks, mouse, keyboard, BIOS and video card can identify themselves and provide management information to standards-based management software.
- **SMART hard drive.** The disk can indicate when it may be about to fail, giving the user time to avoid data loss.
- **Hardware monitor.** The system tracks various indicators of hardware health, such as temperature or chassis open.

Net PCs are “managed” business PCs that cover the full range of price/performance, including high-power systems based on Intel’s Pentium® II processor. Products based on the guidelines are emerging at a wide range of performance levels and price points. The Net PC System Design Guidelines was developed by Intel, Microsoft*, Compaq*, Dell* and Hewlett-Packard*.

Benefits to Users:

With its advanced management technologies, controlled configurations and sealed case, the Net PC gives IT managers increased control over the distributed computing environment. In addition, The Net PC offers a platform that is cost-effective to deploy, manage and support, without sacrificing the desktop computing power, local storage and application flexibility that make the PC a versatile and powerful tool for users. By combining PC versatility and performance with centralized, network-based manageability, the Net PC truly delivers a valuable new tool for business. The Net PC is most appropriate for companies centralizing PC management and for those data- and task-focused users who need no hardware expandability. For example, it is ideal for information delivery, customer support, manufacturing, finance and training.

Benefits to Manufacturers:

The overall Net PC solution is spurring the adoption of manageability by driving initiatives to increase base client management capability. By designing to the Net PC System Design Guidelines OEMs will be able to integrate network-based remote manageability features into their business desktop PC product lines.

Industry Status:

Intel’s announcement of the Wired for Management (WfM) initiative in September 1996 generated considerable enthusiasm for managed PCs from OEMs, independent workgroup and enterprise management software vendors, and end-users. Intel has followed up the initial announcement with a series of events and tools delivered to the industry in 1997. The following events have taken place this year to further enable manageability in PCs and servers:

- *Publication of the Wired for Management Baseline 1.0*
- *Publication of the Net PC System Design Guidelines*

- *Net PC Interoperability events (June and September)*
- *Net PC Introduction and Product Announcements*
- *Publication of the Wired for Management Baseline 1.1a*
- *Publication of the Wired for Management tool kit*
- *Introduction of LANDesk® Client Manager v3.1*
- *Introduction of LANDesk® Management Suite 6*

The second WfM Baseline and Net PC Interoperability test was held on September 26, 1997. Over 20 OEMs, IHVs, and Manageability vendors attended and tested their products showing that Manageable PCs and Net PCs are here now and so are the tools to manage them (see the **press release** describing the event at <http://www.intel.com/pressroom/archive/releases/WM092997.HTM>).

Intel also provided detailed technical training and tools to further assist OEMs and IHVs in implementing the WfM Baseline specification at the Intel Developer Forum held on September 29, 1997. For more information on the **IDF WfM track** please go to (<http://developer.intel.com/ial/wfm/class/index.htm>). Intel will host the **next IDF on February 17** (<http://developer.intel.com/design/idf>), so don't miss the WfM technical details provided there.

Net PC systems began shipping from OEMs in the third quarter of 1997.

Next Steps:

Specifications have been available on both the WfM Baseline and the Net PC since early 1997. Tools and training have been delivered to the industry. Two interoperability events have been held showing the momentum behind WfM baseline and Net PC and the arrival of product building blocks. Now is the time for OEMs, IHVs, and Manageability software vendors to design and deliver WfM-based and Net PC products so that businesses can take advantage of this technology to reduce total cost of ownership.

Stay tuned to Platform Solutions for the next WfM and Net PC Interoperability Event expected in the first half of 1998, and news on the **next Intel Developer Forum** (<http://developer.intel.com/design/idf>) in February 1998.

For More Information:

For more details on Net PCs, visit **Intel's Net PC web site** at (<http://www.intel.com/businesscomputing/netpc/>).

For more details on the Wired for Management initiative from an IT perspective, visit **Intel's Managed PC web site** at (<http://www.intel.com/managedpc/index.htm>).

For all the instructions, tools, and specifications for delivering Wired for Management systems and products, visit the **WfM Toolkit site** at (<http://developer.intel.com/ial/wfm/>).

Platforms: (continued)

Home Platforms

What's New

- New web page shows the **Opportunity for Home Networks**
(<http://www.intel.com/home/network/>)
- Check out Intel's **New Connected Car PC web site** (yes, PC platforms for the car!)
(<http://developer.intel.com/technology/carpc/>)
- Intel's reorganization forms **new Consumer Products Group** to focus on consumer desktop PCs, TV Set-Top Computers, and Connected Car PCs.
(<http://www.intel.com/pressroom/archive/releases/CN112497.HTM>)
- **Intel is enabling new Home platforms** for *Entertainment, Creativity, and Education*. Read Issue #3 Top Story by John Davies, Intel Vice President and Director of Consumer Desktop Products
(<http://developer.intel.com/solutions/archive/issue3/stories/top3.htm>)
- Intel Releases **971 PC Camera Kit** for Production of Affordable, Easy-to-Use, Portable PC Cameras
(<http://www.intel.com/pressroom/archive/releases/pi110397.htm>)

Overview

The Home PC is already the center of creativity, entertainment and education in many households today. With the advent of the Pentium® II processor and Dual Independent Bus (DIB) architecture, and new platform technologies such as AGP, USB and DVD, the home PC is bringing new compelling capabilities to both experienced consumers and first-time buyers. The introduction of Intel's Pentium II processor, when combined with the Internet and the emergence of PC photo processing, video editing, 3D graphics, digital audio, and video phones, is changing the way we work, learn, play, and communicate using our PCs at home.

Advancing the processor and platform technologies is critical to driving new levels of performance and capability that enable new and exciting PC platform uses. These new platform technologies go hand in hand with the enhanced capabilities of the Pentium II processor. Now available at speeds of 233, 266, and 300 MHz, the Pentium II processor combines the advanced features of Intel's sixth-generation processor, like Dynamic Execution and Dual Independent Bus architecture, with the enhanced multimedia and communications processing power of MMX™ technology.

The Pentium II processor delivers the best performance on all three vectors of computing: integer execution, delivering higher performance on all consumer software; floating point, delivering improved 3D graphics for more realistic images and games; and multimedia, using MMX technology to deliver improved imaging, video, and communications. When combined with Intel's newest AGP chipset, arcade quality graphics and DVD are possible now on the mainstream consumer PC.

Experienced PC users tend to demand the best PC performance in order to be ready for new and exciting applications. Multipurpose PCs are evolving into special categories focused to meet the needs of these consumers. Two major trends have emerged in consumer PC usage today: creativity and entertainment. Intel is enabling platform improvements that support these trends through the Creativity PC and the Entertaining PC initiatives. These initiative are intended to enhance the value of the Home PC platform for Creativity, Entertainment, Education and Communication applications.

Creativity:

The **Creativity PC** (<http://developer.intel.com/solutions/tech/creapc.htm>) enables enhanced multimedia and imaging capabilities to make possible:

- Personal photography and albums
- Audio mixing and remixing
- Video editing
- Communicating your creations with family and friends

The emergence of low-cost digital cameras with USB connectivity is making the Creativity PC a hot new category this year. These cameras utilize the PC processing power of the Pentium II processor with MMX technology to allow you to capture, store, edit, and send digital photos over the Internet.

Entertainment:**Entertaining PC**

The Entertaining PC takes the traditional consumer desktop multimedia PC to a new level of capability using the Pentium® II processor, DIB architecture, AGP, DVD, and AC '97 Audio. Consumers who enjoy games and edutainment will now be able to experience a dramatic new level of 3D realism. With the inclusion of DVD drives, the Entertaining PC allows the user to play back high-quality DVD movies and take advantage of rich interactive DVD applications. With DVD, ISVs are taking advantage of the increased storage capacity to provide higher quality video, audio and graphics in games, edutainment and reference applications. Please see the following pages in Platform Solutions to learn how Intel is enabling these critical Entertaining PC platform technologies.

- **AGP** (<http://developer.intel.com/solutions/tech/agp.htm>)
- **DVD** (<http://developer.intel.com/solutions/tech/dvd.htm>)
- **Audio** (<http://developer.intel.com/solutions/tech/audio.htm>)

Family Room Technologies

Intel is also working on technologies to bring new digital broadcasts to the home. Set-Top computers to support digital video and data broadcasts over cable, terrestrial, or satellite are on the drawing boards.

Education:

The Education usage model views the PC as a powerful complementor to the traditional learning process, making the educational experience more interesting, interactive and fun for students of all ages. Creativity PCs and Entertaining PCs are ideal platforms for compelling new educational applications that include realistic 3D graphics, video, 2D and 3D audio, and internet connectivity.

Developers might consider how they can add value in the growing educational applications market segment. For example, today's new Pentium II processor based systems create the hardware headroom which will enable the emergence of powerful new 3D graphics education software applications during 1998. Fast bitmap animation, fast intuitive interfaces, and reference works containing detailed 3D simulations with smooth video and high quality audio all have the potential to transform education for children. These learning tools will be enhanced further as DVD-based interactive software titles become available in increasing numbers in 1998. Most importantly, these new systems will not only support compelling teaching and learning applications for children around the world, these powerful new PCs will become increasingly affordable for use in schools.

Communication:

Towards the truly Connected Home

In addition to the more traditional desktop PC usage in the home, Intel is exploring ways to enable multiple PCs in the home to communicate with one another, thus allowing shared peripherals, shared internet connections, shared files, multi-player gaming, and more. Research shows that there is a large segment of users who could take advantage of home networks. Intel has a new web site that shows a summary of Intel-sponsored research on the **opportunity for home networks** (<http://www.intel.com/home/network/>).

A connected home isn't complete without a connected car. Intel's Connected Car PC technology will offer options such as security, communications, real-time information, internet access, entertainment, and navigation to drivers of the future. See **Intel's Connected Car PC web site** for more information (<http://developer.intel.com/technology/carpc/>).

Creativity PC

What's New:

- See what Intel is doing on-line to **promote creativity** to consumers. Web surfers can learn how to create on-line photo albums or send an internet post card at the **Connected PC site** (<http://connectedpc.com/sites/connectedpc/>)
- Understand **Intel's PC Imaging vision** directly from Peter Green, General Manager of Intel's Digital Peripherals Division, in Issue #3 Top Stories (<http://developer.intel.com/solutions/issue/stories/top4.htm>)
- Intel Announces **New 971 PC Camera Kit** for Production of Affordable, Easy-to-Use, Portable PC Cameras (<http://www.intel.com/pressroom/archive/releases/pi110397.htm>)
- Check out Intel's **New PC Imaging Web Site for Developers** (<http://www.intel.com/design/imaging/>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The Pentium II processor, when combined with cool creativity software, enables new capabilities in:

- Video editing and playback (splice 'n dice your own videos)
- Audio remixing (Mix your own sound tracks)
- PC Imaging (capture, edit images, store and share with friends)
- Web Publishing (communicate with family and friends)

Imaging software has exploded with many popular titles designed for Intel MMX™ technology which brings significant performance to the category. Today digital cameras, scanners and photo printers are widely available at affordable prices. Audio creativity has hit mainstream. Previously audio was available only to musicians with special input devices and complicated software. Now with consumer software and the power of the Pentium II processor, anybody can be a musician.

Some of the features expected on the 1H'98 Pentium II processor-based Creativity PC SKUs are: video capture; audio and video in/out connectors; USB connectors; CD-recordable/Zip drive; PCI audio (AC'97); POTs video conferencing camera; software for video, image, and music editing.

PC OEMs also have the opportunity to include imaging peripherals like scanners, photo printers, and digital cameras.

Other technologies developing on the consumer platform to support Creativity PCs either now or in the future are:

- **USB**—(<http://developer.intel.com/solutions/tech/usb.htm>)
- **1394**—(<http://developer.intel.com/solutions/tech/1394.htm>)
- **AGP**—(<http://developer.intel.com/solutions/tech/agp.htm>)
- **DVD**—(<http://developer.intel.com/solutions/tech/dvd.htm>)
- **Digital Audio**—(<http://developer.intel.com/solutions/tech/audio.htm>)

Benefits to Users:

The Pentium II processor-based PC is the center of Creativity. It is unparalleled in handling pictures and video on your PC. New uses for consumers include photo management and albums, photo editing, personal publishing, Internet post cards, video editing, music creation, and 3D for fun. Here are some examples of what consumers can do with their creativity PCs:

- Entertainment: digital "shoe-box," personalized cards, family tree, games, hobbies, home movies
- Utility: book reports, asset inventory, home improvements
- Sharing: E-mail, WWW, prints
- Video/image management: archival, retrieval
- Image manipulation: enhancement, orientation, size
- Video editing: add text, special effects, transitions
- Small business: presentations, sales collateral, product catalogs, brochures, newsletters, publishing

The PC just got more exciting with the Creativity PC!

Benefits to Manufacturers:

New opportunities to sell new PCs and peripherals. Consumers are looking to buy digital cameras and PCs that have creativity capabilities.

Industry Status:

Creativity PCs are available now! PC OEMs are quickly recognizing the purchasing power of this prospective audience. New creativity PCs are available now from major manufacturers. More are expected in 1998 as the Pentium II processor moves into the volume mainstream.

Intel has developed the new 971 PC Camera kit to enable the production of affordable, easy to use, portable PC Cameras in 1998 from many independent manufacturers. This should help grow the Creativity PC category.

Next Steps:

Offer Pentium II processor-based Creativity PC SKUs in 1H'98 with video editing software, video capture, CD-recordable storage, audio and video in/out. Look for opportunities to sell peripherals and software as part of your Creativity PC SKU. Other opportunities include providing incentives for end-user purchase of peripherals and software.

Take advantage of Intel's Pentium II processor advertising campaign and promote the Creativity PC in the channel and in your advertising to increase awareness for the category.

For More Information:

Intel's **new PC Imaging site for developers** with lots of information on PC Cameras
(<http://www.intel.com/design/imaging/>)

Lots of information available on the usage of Intel's **Pentium II processor for the Home**
(<http://www.intel.com/home/PentiumII/index.htm>).

Visit Intel's **Create & Share™ Camera Pack web site** and learn how the camera and the PC can be used for fun (<http://www.intel.com/createshare/crshare.htm>).

Intel's **PC Imaging initiative site** with lots of new information including links to Intel's Smart Video Recorder III and Kodak's FlashPix* file format site (<http://www.intel.com/imaging/index.htm>).

Information available on other technologies developing on the consumer platform to support Creativity PCs either now or in the future:

- **USB**—(<http://developer.intel.com/solutions/tech/usb.htm>)
- **1394**—(<http://developer.intel.com/solutions/tech/1394.htm>)
- **AGP**—(<http://developer.intel.com/solutions/tech/agp.htm>)
- **DVD**—(<http://developer.intel.com/solutions/tech/dvd.htm>)
- **Digital Audio**—(<http://developer.intel.com/solutions/tech/audio.htm>)

Platforms: (continued)

Mobile Platforms

What's New

- **NEW INTEL PENTIUM® PROCESSORS WITH MMX™ TECHNOLOGY BRING PERFORMANCE BOOST AND VALUE TO MOBILE PCs; New 266MHz and 166MHz speeds**
(<http://developer.intel.com/design/mobile/>)
- Register now for the upcoming **Intel Developer Forum on February 17-19**; Mobile Platform technology implementations for 1998 and Laboratory on Power Savings and Manageability
(<http://developer.intel.com/design/idf>)
- **Intel Mobile Power Guidelines '99, Final Version 1.0** announced by Intel
(<http://developer.intel.com/design/mobile/intelpower/>)
- Intel hosts **fifth MDI interoperability workshop** December 10-11 focusing on global roaming
(<http://developer.intel.com/solutions/tech/mdi.htm>)
- **Intel Power Monitor Version 3.0** announced by Intel and available for download
(<http://www.intel.com/mobile/tecforum/sw.htm>)

Overview

Providing Mobile PC users with the flexible environment they require has always been a challenge. IT management challenges include affordability, maintenance, administration, productivity and security. Notebook users need desktop equivalent capabilities in a mobile form factor that's portable. They won't sacrifice performance for mobility, and they need the lowest possible power consumption providing the longest battery life on the road. Users also require seamless communications—over the LAN, the phone line, and through wireless technologies.

Intel is meeting those challenges with its mobile computing vision: anytime, anywhere performance and productivity. Intel is committed to enabling and delivering cost effective, high performance computing solutions that focus on power efficiency, remote manageability, and mobile communications.

Mobile Power Initiative

Intel recently increased the performance per watt once again with the introduction of the new mobile Pentium® processor with MMX™ technology at 266MHz. However, as the industry prepares to design systems for 1999—and users continue to demand more features—balancing power, battery life and size is ever more challenging. By designing with the Mobile Power Initiative in mind, it is possible to deliver high-end mobile features without sacrificing reliability and extended battery life.

The **Mobile Power Initiative** (<http://developer.intel.com/solutions/tech/mpi.htm>) is an industry-wide program for mobile PC system manufacturers, component suppliers and software vendors. This comprehensive initiative addresses the industry's power consumption challenges in three major areas: System Hardware, System Software, and Application Software. Intel has made available new high-performance, power efficient microprocessors and other building blocks, new Mobile Power Guidelines (Version 1.0 now available), and a broad array of tools and specifications to support power efficient hardware and software development. The Mobile Power Initiative is supported by a broad array of leading PC system manufacturers, component suppliers and software vendors.

Mobile Manageability

Through the **Wired for Management Initiative** (<http://developer.intel.com/solutions/tech/wfm.htm>), Intel is leading the industry to define and deliver the managed mobile PC. Mobile manageability was added to the WfM Baseline specification in June '97, and Intel is providing mobile instrumentation tools and software to enable mobile OEMs to offer managed mobile PCs.

Mobile computers are only occasionally connected; they have a smaller 'pipe' connection, and they tend to use a variety of dynamically swappable devices. But administrators still need all of the desktop management features, such as software distribution, asset tracking, and remote diagnosis/repair, plus additional features to address unique mobile challenges. Intel's WfM initiative is now addressing these for mobile computers.

By offering mobile manageability solutions—such as tools to enable platform instrumentation, as well as the LANDesk® Client Manager application—we are able to lower the total cost of ownership by providing mobile clients and administrators with reduced downtime and higher productivity than ever before.

Several leading manufacturers are already shipping early versions of mobile managed PCs. These systems provide desktop equivalence while connected to the LAN. Intel will help OEMs to enable more fully instrumented notebook platforms and remote dial-up in the first half of 1998.

Mobile Data Initiative

Formed and led by Intel, the **Mobile Data Initiative** (<http://developer.intel.com/solutions/tech/mdi.htm>) is a cross-industry effort to provide mobile PC users with an easy and affordable wireless connection to data networks, using cellular telephones linked to mobile PCs.

The Mobile Data Initiative unites three exciting technologies. The combination of powerful mobile PCs, digital wireless telephony, and the Internet gives business users new resources that they can leverage while out of the office. With these new products and services, business professionals have fast, reliable and cost-effective access to information wherever their business takes them.

Mobile Power Initiative

What's New:

- **Intel Mobile Power Guidelines '99, Final Version 1.0** announced by Intel, Download it Now! (<http://developer.intel.com/design/mobile/intelpower/>)
- **Intel Power Monitor Version 3.0** announced by Intel and available for download (<http://www.intel.com/mobile/tecforum/sw.htm>)
- Industry Status (below)
- Next Steps (below)

Technology Description:

The Mobile Power Initiative is an industry wide program to assist mobile PC system manufacturers, component suppliers and software vendors in delivering future high-end mobile systems and software within mobile thermal limits without sacrificing battery life. This comprehensive initiative addresses the industry's projected design challenges in three major areas: System Hardware, System Software, and Application Software.

Back in September at the Mobile Power Symposium, Intel introduced the Mobile Power Guidelines '99 version 0.80 for industry review and a broad array of tools and specifications to support power efficient hardware and software development. On December 1, 1997, Intel announced the final version of the **Mobile Power Guidelines for 1999 version 1.0** (<http://developer.intel.com/design/mobile/intelpower/>)

and the latest version of an application software tool called **Intel Power Monitor Version 3.0** (<http://www.intel.com/mobile/tecforum/sw.htm>).

Intel Mobile Power Guidelines '99 Version 1.0

The goal of the Mobile Power Guidelines is to set power targets for mobile components for future mobile platforms and provide advice on how to meet those targets. The key elements include balanced power and performance targets, core and bus voltage roadmaps, and power management recommendations for new mobile technologies, such as IEEE 1394. The Intel Mobile Power Guidelines '99 are supported by leading PC system manufacturers, including IBM*, Toshiba*, Compaq*, Dell* and NEC*, as well as a broad array of component suppliers and software vendors.

The version 1.0 of the Mobile Power Guidelines '99 added two sections that were not in the version 0.80—display and battery life. The following list summarizes the new additions and changes to the final version of the Mobile Power Guidelines for 1999.

- Display Features and Power Targets
- Battery life
 - Factors and assumptions
 - Total system power estimates
 - Battery life calculations
 - Design considerations
- Other additions/changes to other sections based on industry feedback
 - For example, removal of IEEE 1394 internal device port support in 1999

Intel Mobile Power Monitor Version 3.0

The Intel Power Monitor (IPM), originally introduced in October '96, is a software tool that monitors system activity on Pentium® Processor and Pentium processor with MMX™ technology notebook computers running Windows* 95 and WindowsNT* 4.0, to provide information about software that may be wasting power. For example, IPM can capture certain command types, such as PeekMessage, that needlessly waste CPU cycles. IPM can then temporarily fix the power-wasting application code in real-time. With the information provided by IPM, Independent Software Vendor's (ISV's) can create power-friendly software.

On December 1st, Intel announced **IPM Version 3.0** and is available today for download. The key new feature in Version 3.0 is the ability to determine hardware device level power. The current devices that can be measured are the central processor and any rotating media such as the hard disk drive, CD-ROM, or floppy drive. If possible in the future, support will be added for other devices on the platform. When estimating device level power, a **Smart Battery** enabled mobile system can allow IPM to more accurately measure power being used by the system.

Benefits to Users:

By implementing the recommendations outlined in the Intel Mobile Power Guidelines '99, the mobile industry should be able to meet the growing user demand for more compelling features and performance while providing reasonable battery life. In 1999, mobile computer users should get more robust systems with high-performance processors, exciting 3D graphics, soft MPEG 2 playback on DVD drives, and new features like the IEEE 1394 I/O bus all within today's mobile thermal limits. Systems designed to the Mobile Power Guidelines '99 should see an increase in battery life from systems designed in 1998.

We all know battery life is important to mobile PC users, and most don't want their software to waste one precious minute of it. In addition to hardware changes in '99, the Intel Application Software Initiative provides guidelines and tools like the Intel Power Monitor Version 3.0 to help software developers create applications that not only perform well, but conserve battery life too. Leading application vendors such as

Microsoft*, Lotus* and Corel* have used IPM and seen up to 60% battery life savings while using their popular suites of office applications.

Benefits to Manufacturers:

The desire for new compelling features continues to drive the growth in the mobile industry. The Intel Mobile Power Guidelines '99 provides a comprehensive plan for system manufacturers to add new and compelling features within mobile thermal limits. System and component manufacturers will be able to deliver more innovative, compelling, and reliable systems by utilizing lower power components and lighter-weight thermal solutions. Dell Computer's Doug MacGregor, Vice President, Portables Business Unit, supports the guidelines as he said, "...when these standards emerge, it will give companies all along the development chain the potential to benefit by offering lower cost components that can be more easily integrated into system designs. This should translate into lower cost, more reliable systems which will be a great benefit to Dell's notebook customers."

The benefit the Intel Power Monitor Version 3.0 brings to ISV's is that they can now measure their applications impact on subsystem power. Previously, they could only view total system power. With this new feature, they can tell when their application uses these devices and tune their application for power efficiency. In addition, Independent Hardware Vendors (IHV's) can now use the program to test the impact of applications on their specific device in the system.

Industry Status:

As we mentioned earlier, the Intel Mobile Power Guidelines '99 version .80 was announced at the Intel Mobile Power Symposium in September of 1997. Since then Intel added two new sections on displays and battery life and a few other edits to make up version 1.0 announced on December 1st, 1997. Throughout the second half of 1998 and into 1999, we expect to see announcements of mobile components and systems that support the recommendations outlined in these guidelines. We will track and recognize these developments and announcements with periodic updates to the Intel Power Initiative developer web site, as well as this Platform Solutions news page. This should help keep the mobile industry informed of the progress of the Intel Mobile Power Initiative as we move towards 1999.

Next Steps:

Please download a copy of the Intel Mobile Power Guidelines Version 1.0 from the **Intel Mobile Power Initiative web site** (<http://developer.intel.com/design/mobile/intelpower/>).

- Implement the recommendations in your systems and components planned for production in the 1999 time frame.
- Participate in Intel and mobile industry enabling programs for implementation recommendations of key technologies like IEEE 1394.
- Participate in future IMPG development activities
- IMPG '00 development starts in the second half of '98

Download the **Intel Power Monitor Version 3.0** (<http://www.intel.com/mobile/tecforum/sw.htm>) and utilize this tool along with **Intel's Mobile Application Guidelines** (<http://developer.intel.com/design/mobile/intelpower/>) to develop "mobile friendly" applications.

Don't miss the Mobile technology training track at the **Intel Developer Forum on February 17-19** (<http://developer.intel.com/design/idf>). Intel's Mobile architects will provide technical details on the latest Mobile platform technologies including the Mobile Power Guidelines '99.

Continue to provide your Intel Power Initiative input to Power@intel.com.

For more Information:

For more information on the Intel **Mobile Power Guidelines '99** Version 1.0 (<http://developer.intel.com/design/mobile/intelpower/>)

For more information on **Intel Power Monitor Version 3.0**

(<http://www.intel.com/mobile/tecforum/sw.htm>)

For more information on the **Smart Battery System**

(<http://www.sbs-forum.org>)

To get more details on Software and the **Mobile Software Guidelines**

(<http://www.intel.com/mobile/tecforum/sw.htm>)

For more details on the **Intel Mobile Power Initiative**

(<http://developer.intel.com/design/mobile/intelpower/>)

For more information on **Mobile System Software and OS power management**

(<http://www.intel.com/mobile/tecforum/os.htm>)

Mobile Data Initiative

What's New:

- North American MDI **membership expands** to 29 companies
(see below)
- Intel's **Fifth MDI Interoperability Workshop** focuses on global roaming
(see below)
- Resellers join MDI to ensure **complete solutions** are available in the channel
(see below)

Technology Description:

The Mobile Data Initiative (MDI) is an affiliation of leading technology companies including mobile phone network operators, telecommunications vendors, and mobile PC hardware and software manufacturers. Intel established and leads the MDI with a goal of enabling mobile users to stay connected via a simple, cost-effective wireless connection to data networks.

MDI endorses GSM (Global System for Mobile Communications) technology as the best way to exchange data wirelessly today. GSM is secure, reliable and has the most extensive global coverage of all digital networks. In fact, GSM is used by over 50 million people throughout the world today. PCS1900, an adaptation of the GSM standard for North America, is compatible with GSM networks in Europe and elsewhere around the world. MDI will also endorse other digital wireless telephony technologies as soon as they become business-ready.

Wireless Data Solutions Benefit Users:

Wireless mobile computing makes users more productive by making it possible for business travelers to stay connected when and where they need to.

By simply connecting a digital wireless telephone to a notebook computer, business travelers can remotely gain secure access to all of the resources they have while in the office: e-mail, fax, corporate LAN and Internet/intranet. So the downtime that travelers often experience, whether waiting for a flight, in a cab or on a train can now become productive work time.

Wireless data also makes sure time-critical data reaches travelers. There's no need to wait for a hotel fax or even a phone jack. So last-minute changes to presentations or pricing information can be downloaded right from the customer's lobby.

Best of all, it's easy. The technology leverages notebook PCs and mobile phones, both powerful tools that business travelers already use. So there's no need to learn to use a new device or to carry extra equipment along—the same phone business travelers use to talk can also be used to transmit data.

MDI —an Opportunity for Manufacturers:

Intel continues to spearhead the Mobile Data Initiative by bringing industry leaders together with a commitment to delivering seamless, integrated solutions. One major Intel deliverable is the periodic hosting of "PlugFest" interoperability workshops. Manufacturers who participate in these events gain access to a forum where their products can be tested for interoperability, and where they can meet with other industry leaders interested in developing the market for mobile data.

Intel and the MDI are also working to raise the awareness of this technology and its benefits. These efforts are designed to help spur customer demand for all the components of wireless mobile computing solutions: notebook PCs, wireless phones, PCMCIA adapter cards, access to digital wireless networks, communications software, and their distribution channels.

Industry Status:

MDI Membership Expands

The Mobile Data Initiative is a cross-industry effort of industry leaders. The growth in our ranks reflects a broad endorsement of the PC model of wireless communications. PCs are the preferred platform for mobile data because in addition to communications capabilities, they also enable all the other applications users need for a complete mobile office. Expanding membership also indicates the wide range of options users have when selecting mobile wireless data solutions.

Since its launch in October 1996, the European MDI has grown to 41 members. MDI membership in North America has expanded rapidly to 29 members since its launch in August 1997. The current North American MDI members are the following:

Notebook PC Manufacturers*

IBM
Toshiba
Acer
AST
Fujitsu PC
Hitachi PC
Packard Bell/NEC
Transmonde

Software Vendors*

Microsoft
Oracle
Paragon
Symantec

Channel*

Inacom
MicroAge

Wireless Operators*

Aerial Communications
Bell South Mobility
Microcell
Omnipoint
Pacific Bell
Powertel
Western Wireless/Cook Inlet

PC/Phone Interface*

Psion Dacom
TDK Systems
Xircom

Infrastructure*

Ericsson
Nokia
Cisco Systems
Nortel
Motorola

Fifth Interoperability Workshop Focuses on Global Roaming

Intel held its fifth MDI interoperability workshop, or "PlugFest", December 10-11 in Oklahoma City. The focus of this event was global roaming: ensuring that when users are traveling outside of their home coverage areas, they can continue to send and receive wireless data communications. The emergence of "Internet roaming enabler" companies is making such communications much more cost-effective, allowing travelers to call local phone numbers around the world when accessing their home Internet Service Providers.

Intel hosts periodic interoperability workshops to help fulfill its mission of ensuring that a wide variety of seamless, easy-to-use solutions are available for business users. As new wireless products and technologies come into the mainstream, future PlugFests will continue to ensure their interoperability with horizontal solutions.

This event was held in conjunction with a Strategy and Marketing Meeting, in which MDI members planned activities for 1998 that will help develop the market for wireless data.

Resellers Join MDI to Ensure Complete Solution Availability

Resellers represent a new category of membership in the Mobile Data Initiative. Intel has brought resellers into the initiative because they play an important role in the delivery of computing solutions to users. Through consulting, configuration, and support services, resellers are in a unique position to evaluate and fulfill the needs of business customers. Because of this, the MDI is working to make complete wireless computing solutions—notebook PCs, digital wireless phones, and wireless data modems—available in the reseller channel.

Next Steps:

If you would like more information about the Mobile Data Initiative, or would like to participate in the next "PlugFest" interoperability workshop, please complete a form at one of the following web sites:

In North America, http://www.pcsdata.com/feedback_cgi.html

In Europe, http://gsmdata.com/feedback_cgi.html

For More Information:

To get more information about the Mobile Data Initiative, visit the **North American MDI web site** (<http://www.pcsdata.com/>)

Or visit the **European MDI web site** (<http://gsmdata.com>)

Intel's **Mobile Computing/Wireless Data Communications site** also provides a broader view on wireless mobile computing issues and implementation in the U.S. as well as Europe (<http://www.intel.com/mobile/entrprse/wireles.htm>)

If you're not familiar with the initiative's origins, get some background on the **history of MDI** (<http://www.intel.com/mobile/entrprse/mdi.htm>)

Platforms: (continued)

Server Platforms

What's New

- Don't miss the Server Platform Technologies track at the **February 17th Intel Developers Forum (IDF)**. Intel's server architects have planned detailed training on the hottest SHV server technologies driving the platform today. Register now before it's too late!
(<http://developer.intel.com/design/idf>)
- **Intel Architecture Servers: The Unifying Architecture for Enterprise Servers**; Read the Feature Story by John Miner, Vice President and General Manager of Intel's Enterprise Server Group
(<http://developer.intel.com/solutions/issue/feature.htm>)
- **Growing the Standards Base for High Volume Servers**; Read the Focus article from Intel's Server Architecture Lab with Intel Fellow Justin Rattner and Director of Platform Architecture Paul Close
(<http://developer.intel.com/solutions/issue/focus.htm>)
- **Common Ground for Server Management Hardware**; Read the Top Story from Intel's Marketing Directory for High-End Servers, Kevin Soelberg
(<http://developer.intel.com/solutions/issue/stories/top3.htm>)
- **The SSI Initiative: Defining a Specification for Server System Infrastructure**; Read the Top Story from Intel's General Manager of Entry/Mid-Range Server Division
(<http://developer.intel.com/solutions/issue/stories/top4.htm>)
- **Increasing Competitive Advantage with products based on I₂O[®] technology**; Read the Top Story from BMC Software's Vice President of Application Management Products, Kirill Tatarinov
(<http://developer.intel.com/solutions/issue/stories/top5.htm>)
- **New Server Technology pages** now available on key SHV server initiatives:
 - Server Platform Management Hardware
(<http://developer.intel.com/solutions/tech/platmgmt.htm>)
 - Server System Infrastructure (<http://developer.intel.com/solutions/tech/ssi.htm>)
 - Virtual Interface Architecture (<http://developer.intel.com/solutions/tech/via.htm>)
 - Intelligent I/O (I₂O[®]) Architecture (<http://developer.intel.com/solutions/tech/i20.htm>)
- **Intel expands investment in Server Activities**; Plans new Design Center in Pact with NCR
(<http://www.intel.com/pressroom/archive/releases/SP010998.HTM>)

Overview:

The economics of volume that have governed the PC marketplace for the past 20 years are now sweeping the server scene. Moore's Law-driven advances in microprocessor performance along with market-driven industry standards are greatly advancing the price/performance and capabilities of mainstream server platforms based on the Intel architecture. (For more information on **Moore's Law**, please see the feature article by Dr. Gordon Moore in Issue #2 of *Platform Solutions* - <http://developer.intel.com/solutions/archive/issue2/feature.htm>). Innovation happens faster as more vendors compete to offer better solutions at lower prices. Improved products attract an even larger market. Prices fall, customers get more value per dollar spent, while vendors continuously improve their efficiency, and the cycle repeats. The result?--newer and better products that draw ever-increasing numbers of users and vendors to this dynamic and richly rewarding opportunity.

These standard, high-volume (SHV) servers – enabled by key technology advances in the areas of scalability, availability, manageability and flexibility – are handling the vast array of old and new business computing models and applications that the current era of network-oriented computing and the Internet has created.

Intel's Processor Roadmap for Servers

Intel designs and builds microprocessors specifically for the server market. Intel's processor roadmap for servers promises to deliver building blocks for new generations of SHV servers that will be capable of delivering truly 'mainframe-class' (and beyond) levels of capacity, processing power and availability. Following Moore's Law, new Intel server-focused processors are rolling out on 18-24 month cycles, with raw performance at least doubling every time. Today's Pentium® Pro and Pentium II processors will soon be joined by Intel's newest processor for servers and workstations with a new, server-specific cartridge configuration called Slot 2. In 1999, Intel plans to deliver the Merced™ processor, the first in a series of IA-64™ architecture processors. Intel will continue to deliver robust roadmaps for both 32-bit and 64-bit processors designed to meet an ever-broadening range of business server computing requirements.

Complementing advances in Intel processor capabilities, SHV servers will also feature continued advancements in L2 (second-level) cache speeds and sizes, increased system bus speeds and bandwidths to support increasing numbers of processors, and significantly enhanced I/O capacity and throughput. In addition, advances in memory technology will enable significantly larger and faster main memories to be affordably implemented in SHV servers, up to a theoretical maximum of 64GB of physical memory (the limit of the 36-bit physical addressability of the IA-32 processor family). Collectively, these advances will enable larger SMP (symmetric multiprocessing) server systems. These platforms will remain well balanced, both in terms of I/O vs. processing capacity for a variety of workloads, and in terms of delivered cost per unit of performance.

Scalability

To Intel, "scalability" means "never being forced to turn away requests for service due to lack of computer system resources." Intel and the SHV server industry are addressing the scalability challenge in two ways. First is the ongoing, rapid improvement of the performance and throughput of the core electronics complex, including Intel processors and chip sets. There are SHV servers on the market today featuring 4-way SMP, and Intel is working with the industry to deliver 8-way-scalable SHV servers, based on standard Intel Architecture processor building blocks. A number of Intel customers are using these scalable building blocks to construct still larger-scale SMP systems designed to handle the largest workloads of the very largest Global 100 companies.. The second way that Intel is addressing scalability needs is through industry-standard, extremely high-performance methods of combining multiple SHV servers together into robust scalability clusters To bring clustering to the SHV server world, Intel co-developed with Compaq* and Microsoft* the **Virtual Interface (VI) Architecture** (<http://developer.intel.com/solutions/tech/via.htm>) specification which defines a standard mechanism for low-latency, high-bandwidth message-passing between interconnected SHV servers and storage devices and other servers in a System Area Network (SAN). The VI Architecture is designed to enable the SHV server industry to deliver high-performance, scalable clustered systems at a fraction of the price of proprietary RISC and mainframe alternatives. In addition, the portability of cluster-aware software based on VI Architecture will allow customers to run their most complex enterprise applications on more affordable, industry standards-based servers, which should reduce both total cost of ownership and initial cost of acquisition and deployment.

With their inherent capabilities for SMP and clustering, SHV servers will exhibit virtually limitless scalability, regardless of the scale of workloads they are made to handle. In the era of the Internet and e-commerce, effectively limitless scalability is an important characteristic of the server infrastructure.

Manageability

There are several technology initiatives that establish management capabilities for SHV servers and that provide guidelines for making SHV servers fit smoothly into existing IT management infrastructures. The **Wired for Management Initiative (WfM)** (<http://developer.intel.com/solutions/tech/wfm.htm>) defines a minimum set of management capabilities for servers. These include requirements for instrumentation, remote wake-up, power management, and server reboot capability. Wired for Management takes

advantage of existing standards and management technologies such as DMI, SNMP, and ACPI (Advanced Configuration and Power Interface) and provides developers with a much-needed foundation for designing manageability into server platforms. Along with the WfM baseline specification, Intel offers a set of development tools to facilitate deployment of these capabilities. These include the Intel DMI 2.0 Service Provider SDK, the Managed Objects Toolkit, and the DMI SDK for Servers.

Another key aspect of server manageability in support of the WfM initiative is **Server Platform Management Hardware** (<http://developer.intel.com/solutions/tech/platmgmt.htm>). Intel is working with the industry to define a soon to be released specification that defines a common interface and bus protocol for platform management hardware. This specification will support the WfM initiative which already defines the major server management software standards.

Complementing the WfM initiative and related standards, Intel continues to work on enhancing the manageability features of vital server platform elements including processors, power supplies and critical portions of the system infrastructure. The goal is to have a very high yet broadly available, standards-based level of system manageability and as a result the lowest possible TCO delivered with SHV servers based on Intel Architecture.

Faster I/O

Server I/O capacity and throughput are crucial to the overall performance and headroom of the server application. Intel has been working through the years to improve server I/O subsystem capacity and throughput. The results of that effort have already been significant. From ISA to EISA to PCI, and on to multiple PCI buses in a single server, Intel provided much of the core technology and enabling silicon products that permitted these improvements. Another example is the Dual Independent Bus (DIB) architecture, first implemented in the Pentium Pro processor and now part of the Pentium II processor, which dramatically improved memory bandwidth performance.

Though the PCI bus has been the workhorse over the past several years, the processor complex has advanced so fast that the need for more I/O capability only continues to grow. When a single PCI bus supports 64-bit data transfers and runs at 66 MHz (the "peaks" allowed under the PCI 2.1 specification), its 528 Mbyte per second peak transfer rate makes it a much more viable building block for latency- and bandwidth-sensitive server I/O subsystems. Intel processors and chipsets for servers will soon provide a standard foundation for realizing the highest levels of PCI-based I/O capabilities. Newer servers based on Intel Architecture will also feature larger numbers and combinations of (32- and 64-bit) PCI buses, as well as more PCI expansion slots than are generally available in today's SHV servers. At the same time, Intel has started to look into 'next-generation' I/O solutions that will take server I/O capabilities well beyond what PCI can offer today.

In addition to providing the core technologies and building blocks for SHV server I/O subsystems, Intel is also actively promoting the **Intelligent I/O (I₂O[®]) Architecture** (<http://developer.intel.com/solutions/tech/i20.htm>), an industry standard for allowing I/O subsystems to operate in an intelligent fashion by offloading a significant portion of I/O tasks onto specialized I/O processors (IOPs). I₂O technology delivers improved driver standardization for all device types, and promises to deliver better system-level aggregate throughput for storage and LAN interactions to end users. In the long-term, I₂O technology promises to greatly simplify the process of supporting multiple operating systems and their versions, resulting in more rapid delivery of improved I/O subsystems over time. Products using I₂O technology are being delivered today by a number of server systems vendors, independent hardware vendors (IHV's) and operating systems vendors (OSV's).

Today, I₂O architecture is directly associated with the PCI bus—the message-passing that occurs between the host OS and the IOP is specifically architected for the PCI bus itself. While this is a fine initial approach, it has a long-term limitation in that realistically there can only be a limited number of PCI buses and associated expansion slots in a given server. Intel is actively working within the I₂O SIG (special interest group) to incorporate VI Architecture into the next generation (version 2.0) of the I₂O specification. The goal is to bring the benefits of standards-based, high-performance, network-attached I/O to the SHV server platform—regardless of the nature of the underlying system-area network interconnect itself.

Flexibility

Today's SHV servers come in all shapes and sizes. Intel believes that it is both possible and desirable to create industry standards for selected server system design elements such that many different types of SHV systems can be configured from standards-based building blocks. A system vendor or systems integrator could configure a very large-scale compute server, for example, with many multiprocessing compute nodes in a cluster, and relatively little I/O capacity. A large-scale data-warehouse platform could be constructed from many processor and I/O subsystem building blocks. The common denominators between all of these configurations are industry-standard building-block modules and standards-based, high-performance clustering interconnects. One example of this trend in SHV servers is the **Server System Infrastructure (SSI) initiative** (<http://developer.intel.com/solutions/tech/ssi.htm>) which Intel is leading to define the common elements of current and future server infrastructures, and to help the industry develop a common set of specifications around them.

SHV Servers -- Destined for Continuous Success in Business Computing

The SHV servers of tomorrow will offer significant advances over the proven workhorse SHV servers of today. With unparalleled processing power through best-in-class 32-bit and revolutionary 64-bit processors, coupled with state-of-the-art RASM (reliability, availability, serviceability, and manageability) features, native clustering capabilities, and significantly enhanced I/O subsystems, future SHV servers will take on business computing tasks that are hardly imaginable today. Thanks to the innovative and cooperative efforts of the entire server industry, customers can look forward to SHV servers that are more powerful, more flexible, more scalable, easier to manage, and easier to integrate into existing and evolving business computing environments.

Virtual Interface (VI) Architecture

What's New:

- **Virtual Interface (VI) Architecture specification now available;** Intel, Compaq*, and Microsoft* announce availability of version 1.0
Press Release (<http://www.intel.com/pressroom/archive/releases/sr1216b.htm>)
Download it now!(http://www.viarch.org/html/Spec/vi_specification_version_10.htm)
- Check out what the **press is saying** about Virtual Interface (VI) Architecture.
(<http://www.viarch-esg.org/html/News/news.htm>)
- **Development tools** for creating VI Architecture based products will be available from Intel in February. (link below to the 2nd paragraph in Industry Status)
- Attend the **February 17 Intel Developer Forum (IDF)** to learn more about implementing VI Architecture-based products directly from Intel's top server architects
(<http://developer.intel.com/design/idf/>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The concept of **clustering**, the linking together of individual servers and workstations into a cohesive unit, has helped shape many advances in enterprise-wide distributed computing. Many companies have adopted clustering technology for its ability to provide availability and scalability for mission-critical applications such as data warehousing, decision support, and transaction processing.

Effective clustering requires high-speed, high-bandwidth communication between nodes. Over the last 15 years, high-speed networking hardware has advanced rapidly, with technologies such as ATM, Fast Ethernet and Fiber Channel offering orders-of-magnitude improvements over previous LAN and WAN technologies. On the software side, however, the overhead associated with communicating between the nodes of a cluster has remained essentially unchanged—until now.

The **Virtual Interface (VI) Architecture** specification, an industry initiative spearheaded by Intel Corp., Compaq Computer Corp.* and Microsoft Corp.*, is a revolutionary breakthrough in cluster communications. VI Architecture defines a standard interface for low-latency, high-bandwidth communication that bypasses the traditional software overhead. Elimination of this overhead not only enables significant communication performance increases, but also results in a significant increase in the number of CPU cycles available for performing other tasks.

Benefits to Users (IT):

Past cluster solutions were based on proprietary hardware and software interfaces. These solutions only ran on a single hardware configuration supported by a single operating system. There was little investment protection available as technological advances occurred.

VI Architecture ushers in a new era for distributed enterprise computing. VI Architecture enables the construction of clusters around the common building blocks of Intel Architecture (IA)-based standard high-volume (SHV) servers and commercial, off-the-shelf operating systems. By defining a standard hardware / software interface, technological advancement in both application software and communication hardware can occur without sacrificing future compatibility.

Using IA-based SHV servers, this new paradigm delivers the enterprise-class scalability and availability that businesses need for high-performance, mission-critical applications – at a fraction of the cost of traditional, proprietary mainframe and RISC-based clustering technologies. Using VI Architecture, clusters of **Intel Architecture**-based SHV servers can now be used to address scalability and availability solutions at **all levels of the enterprise**.

Benefits to Manufacturers:

VI Architecture enables vendors to design and optimize their communication hardware and application software for a single hardware/software interface. This single interface allows these vendors to create their products in volume. The economies achieved through volume manufacturing allow clusters to be assembled at a fraction of the price, while surpassing mainframes and supercomputers in both performance and reliability. This fosters the growth of economical, innovative implementations, which offer more value to end users.

Industry Status:

The VI Architecture specification version 1.0 has been completed and is **publicly available for download** (http://www.viarch.org/html/Spec/vi_specification_version_10.htm). The specification was jointly developed by Intel, Compaq*, and Microsoft* and reviewed by the industry prior to completion. Since the original development efforts began in January 1996, more than **100 other server industry leaders** (http://www.viarch.org/html/Contributors/vi_contributors.htm) have joined to endorse the collective endeavor.

Enabling the industry to create VI Architecture conformant products requires world-class development tools. Intel is currently creating guides and tools to facilitate the development of these next-generation communication products. These guides and tools will enable the industry to develop products and solutions that conform to the interface referenced in the VI Architecture specification. These guides and tools are currently under development and will be available online in February at (http://www.viarch-esg.org/html/the_spec/guides/guides.htm).

Many vendors will be announcing VI Architecture-enabled products in the coming months.

Next Steps:

For detailed information about VI Architecture **download version 1.0 of the specification now!** (http://www.viarch.org/html/Spec/vi_specification_version_10.htm)

If you are planning to implement VI Architecture-enabled hardware or software products, be sure to attend the **Intel Developer Forum** (<http://developer.intel.com/design/idf/>) on February 17-19 to get implementation details straight from Intel's top server architects.

For More Information:

Visit **Intel's Virtual Interface (VI) Architecture site** for more details on VI.
(<http://www.intel.com/procs/servers/isv/vi>)

Visit the **VI Architecture industry web site** for more details on contributors, promoters, and press announcements.
(<http://www.viarch.org>)

Server Platform Management Hardware**What's New:**

- A new specification, lead by Intel and leading server system vendors, for server platform management hardware will soon be released to the industry. This new specification compliments the **Wired for Management (WfM) Initiative** (<http://developer.intel.com/solutions/tech/wfm.htm>) and sets the direction for open, flexible, and scalable platform management hardware for SHV servers
- **Common Ground for Server Management Hardware**; Read the Top Story from Intel's Marketing Directory for High-End Servers, Kevin Soelberg
(<http://developer.intel.com/solutions/issue/stories/top3.htm>)
- Next Steps (below)

Technology Description:

In an effort to lower TCO much attention and effort has been focused on server management software standards such as Desktop Management Interface(DMI), Simple Network Management Protocol(SNMP), Component Information Model(CIM) and Windows Management Interface(WMI), however no standards to date have focused on server platform management hardware. This specification defines a common interface and bus protocol for platform management hardware which helps lower TCO by improving server platform management functionality and compatibility.

As part of an ongoing commitment to create open specifications that enable the adoption of new technologies, Intel and leading server system vendors are currently working on the first version (v0.9) of a new specification which will support the Wired for Management (WfM) initiative. WfM is part of a broad-based industry effort, led by Intel, to integrate all of the pieces of the enterprise architecture in a way that provides greater control and manageability for IT professionals while reducing TCO for large organizations.

Benefits to Users (IT):

TCO is a big issue for corporations today. Major issues identified in the enterprise IT space are: asset management, better/more accurate system monitoring, and access to failure logs (events that occurred prior to system failure). Good overall server management technology is key to reducing TCO by increasing platform availability, serviceability and reliability. The foundation for strong overall server management lies in platform instrumentation namely, the monitoring of a server's physical characteristics such as temperature, voltage, fans, power supplies etc. as well as access to important hardware inventory information.

Servers based on the new specification will help reduce TCO by providing common access to platform management information. The interfaces defined by the specification are designed such that the information can be easily accessed by management software from the system side as well as by an I²C-based management bus. The bus operates autonomously so critical sensors and events can be monitored and logged even if the processor goes down and system management software is not available. The bus also enables devices such as Emergency Management Cards to easily access platform management information.

The specification also enables robust and flexible solutions to be implemented which support a wide range of servers and configurations. The specification is scalable from entry-level to high-end servers providing support for a wide range of sensors, events, and messages across all segments of the server marketplace. The specification is expandable from single to multiple systems to address the requirements of increasingly popular complex configurations such as sever clusters and rack mount systems. The internal management bus can be extended externally to the chassis to manage multiple servers or peripheral chassis, containing components such as RAID drives or power supplies, through a dedicated "out of band" connection. The external bus enables a server to be managed by another connected server even if it has no system management software or the processor is down.

Benefits to Manufacturers:

While all server system vendors offer basic platform instrumentation, most of their solutions are proprietary and limited in their scalability, extensibility, and portability making it difficult to maintain continuity from one generation of server to the next. This specification enables very efficient porting to new server designs. The specification's interface de-couples platform management hardware from server management software allowing hardware advancements to be implemented without impacting server management software. This architecture enables vendors to quickly develop differentiated solutions that can be brought to market very quickly. The specification also facilitates the development of cross-platform management applications enabling the system vendor to support various operating systems and management software standards.

Next Steps:

To ensure the participation of the industry in developing the new specification, Intel and leading server system vendors will soon make the v0.9 specs available on the Web for industry review and feedback. Following industry input, Intel and leading server system vendors plan to release version 1.0 of the specification by the end of Q2, 1998. A press announcement will be released soon detailing the companies involved as well as the website information.

Intel's Server Management Architects also plan to discuss the specification at the February **Intel Developer Forum** (<http://developer.intel.com/design/idf>). So if you're interested in more details you should register to attend today.

For More Information:

Common Ground for Server Management Hardware; Read the Top Story from Intel's Marketing Directory for High-End Servers, Kevin Soelberg (<http://developer.intel.com/solutions/issue/stories/top3.htm>)

For more information on Intel's **Wired for Management (WfM) Initiative**, please visit the WfM technology page in Platform Solutions (<http://developer.intel.com/solutions/tech/wfm.htm>)

Stay tuned to this page as information unfolds around Server Platform Management Hardware.

I₂O Technology**What's New:**

- **Increasing Competitive Advantage with products based on I₂O[®] technology**; Read the Top Story from BMC Software's Vice President of Application Management Products, Kirill Tatarinov. He discusses the architecture of BMC's PATROL software, its impact to I₂O[®] technology and opportunities for server systems suppliers and IHVs (<http://developer.intel.com/solutions/issue/stories/top5.htm>)
- **I₂O[®] White Paper** by Aberdeen Group Available for Download Today (<http://www.intel.com/procs/servers/press/aberdeen/body.htm>)

- Intel's **I₂O Web Site** Targeted at IT Managers with detailed Information (<http://www.intel.com/procs/servers/i2otech/>)
- Industry Status (see below)
- What's New (see below)

Technology Description:

I₂O[®] technology is evolving the concept of intelligent I/O by providing an industry-accepted specification for the development of intelligent I/O solutions. The two primary objectives of the I₂O specification are to improve system-level performance by off-loading the host CPU of I/O tasks, and to enable the general portability of I/O device drivers across operating systems. The I₂O Architecture is a software specification that provides a standardized framework for the implementation of intelligent I/O subsystems. The concept of intelligent I/O was first introduced in mainframe systems to balance the I/O and compute power of the platform. Special "channel processors" were used to control I/O-specific tasks in these proprietary solutions.

The I₂O specification replaces the standard monolithic device driver with a two-piece driver model composed of the Hardware Device Module (HDM) and the OS Service Module (OSM). The HDM runs on the I/O processor (IOP) and serves as the interface to the target I/O device. The OSM runs on the host processor and serves as the interface to the host operating system. OSMs are developed for each I/O class defined by the specification, and are unique to each operating system. The HDM and OSM communicate over a *messaging layer* using a defined message-passing protocol. This de-couples both the underlying bus or interconnect topology and the HDM of the I/O device from the host OS. For a given device, a single HDM can be developed and used with any OS supporting the I₂O Specification. This model also provides the capability for direct communication between HDMs, thereby laying the foundation for peer-to-peer data transfers. In addition, it allows for stackable drivers, providing the capability to add functionality to standard devices, e.g. adding a third party's RAID firmware to any SCSI device driver.

Benefits to IT Community:

I₂O technology delivers improved system throughput as a result of incorporating an I/O processor that off-loads the host CPU of substantial I/O tasks. In addition, the I₂O technology is an essential part of increasing *scalability* in standard, high-volume (SHV) servers. The ultimate goal of scalable platforms is to provide unlimited ability to expand system resources and still produce proportionally greater performance. Once achieved, a scalable environment is clearly a big win for the IT community.

Another key benefit is the interoperability that I₂O technology provides. The split driver functionality of I₂O technology will simplify the task of integrating systems and managing the complex environments with multiple OSs and I/O technologies that are typically found in an enterprise.

Benefits to Developers:

The I₂O Specification also brings the benefit of accelerating adoption of new I/O technologies, e.g. ATM, Fast Ethernet and Fiber Channel. By reducing the effort required to develop and maintain device drivers, more resources can be applied to I/O innovation. In addition, less time is spent by OEMs and IT departments testing and validating the multitude of peripheral cards and drivers that are certified with any given platform. Once an HDM is validated to communicate properly with the messaging layer, it is then expected to work with all future versions of any OS that complies with the I₂O specification.

Industry Status:

There have been various compliance workshops attended by member companies. These workshops are designed to assist member companies in validating the I₂O functionality and compatibility of their products. The products being evaluated are more mature than just a few months ago. Some vendors are nearly ready to announce product availability.

At COMDEX '97 there were 22 vendors showing products and technology based on the I₂O specification. The products included servers, storage adapters, LAN cards, RAID solutions, management software and

development tools. Member companies are committed to proliferating the benefits of I₂O technology and are working together to ensure compliance as well as scalability.

Intel and other industry IA server vendors announced products supporting the I₂O specification at the October '97 Network + Interop. The announcements included servers with I₂O technology and Intel i960[®] I/O processors for shipment during Q1 '98 based on Intel Pentium[®] II and Pentium[®] Pro processors. These server systems vendors include: Acer America Corp.*, AST Computer*, Compaq Computer Corp.*, Dell Computer Corp.*, Gateway 2000*, Hewlett-Packard Co.*, IBM Corp.*, Micron Electronics, Inc.*, Mitsubishi Electric PC Division*, NEC Computer Systems Division*, and NCR*.

The development of the I₂O specification is an industry-wide initiative led by the I₂O Special Interest Group (SIG). Originally established in January of 1996 by a group of computer industry vendors (including Intel), it now has an active membership of over 130 companies. For more information on the I₂O Specification, SIG membership, access to the specification, or developments as an industry initiative, visit the **I₂O SIG* web site** (<http://www.i2osig.org/>)

Since the inception of the I₂O SIG in early 1996, membership in the SIG and product announcements have grown at a significant rate. The industry saw the first demonstrations of I₂O technology at Fall COMDEX '96. Intel has played and is continuing to play a major role in the I₂O initiative, providing I₂O technology building blocks. These solutions include highly integrated I/O Processors (featuring an I₂O technology messaging unit, PCI-PCI bridge and embedded CPU based on the i960 processor) and server platforms featuring I₂O technology solutions.

Next Steps:

If you're involved in I/O hardware or software development, join the I₂O SIG and start investing in the technology that your customers will require. The I₂O Specification is available through the I₂O SIG web site, which also provides information on how to become a SIG member and gain access to the ongoing forums that provide invaluable guidance for your product development decisions.

If you are an IT manager or system administrator, familiarize yourself and your team with the concepts of the I₂O technology and consult with your equipment providers about how they plan to implement I₂O technology solutions in their coming products. The vendors who announced products at the October '97 Network + Interop will be shipping products by Q1 '98 (see **press release** <http://www.intel.com/pressroom/archive/releases/io100797.HTM>). The I₂O SIG web site also contains interesting content for non-developers, including vendor announcements, SIG events and industry developments.

For more information:

Increasing Competitive Advantage with products based on I₂O[®] technology, Read the Top Story from BMC Software's Vice President of Application Management Products, Kirill Tatarinov. He discusses the architecture of BMC's PATROL software, its impact to I₂O[®] technology and opportunities for server systems suppliers and IHVs
(<http://developer.intel.com/solutions/issue/stories/top5.htm>)

Visit **Intel's I₂O web site** targeted at IT managers with detailed information on I₂O technology
(<http://www.intel.com/procs/servers/i2otech/>).

Visit **Intel's Intelligent I/O Processor web site** for developers including information on Intel's i960 RP I/O processor (<http://www.intel.com/design/iio/>).

Visit the **I₂O Industry SIG web site** (<http://www.i2osig.org/>).

Server System Infrastructure (SSI)

What's New:

- **Server System Infrastructure (SSI) initiative launched** to define open industry specifications for common elements within server systems - the infrastructure.
- ***The SSI Initiative: Defining a Specification for Server System Infrastructure***; Read the Top Story in Platform Solutions from Intel's GM of Entry/Mid-Range Server Division, Abhi Talwalker
(<http://developer.intel.com/solutions/>)
- **Industry Status** (see below)
- **Next Steps: SSI draft specification presentation** at the Intel developers forum Feb 17-19 in San Jose, CA
(<http://developer.intel.com/design/idf>)

Technology Description:

During the 1990's servers have undergone a fundamental change in price/performance and functionality, just as PC's did in the 1980's. The rapid pace of server technology redefined the Intel architecture server from desktop PCs deployed as servers to robust, purpose built, multiprocessing systems. To accommodate these changes manufacturers developed a new server chassis for each generation of technology. With each new chassis came a set of unique system elements that could share a common form factor. Instead each new server is designed from ground up since no server standards exist for system designers and industry suppliers. This process forces longer development cycles, greater R&D cost, and low re-use of prior design.

The Intel Server System Infrastructure (SSI) initiative will establish an open industry specification for two common elements of today's and tomorrow's server system infrastructures: power supplies and electronics bays. The latter term refers to the physical space in the server chassis allotted to the motherboard—including the microprocessor, memory, I/O and related chip sets for entry-level servers (in high-end servers, I/O functions are typically handled off the system motherboard).

For power supplies, the SSI specification will address such factors as physical dimensions, wattage range and electro-mechanical interface parameters. In the case of electronics bays, the spec will cover such parameters as size and space, cooling functions, and even physical mounting considerations.

In its final form the SSI specification will be two specification stacks and a set of system design guides. One stack will contain a series of power supplies and the other a series of electronics bays that address all segments of the server market, from entry-level products on up through advanced enterprise servers.

Benefits to Server Manufacturers:

A common specification for server power supplies and electronics bays allows the server manufacturer to design or procure a server chassis with greater assurance of longevity across multiple generations of microprocessor technology. Chassis longevity will allow a system manufacturer to shift a portion of today's R&D budget toward greater value added efforts rather than repackaging existing technology.

An industry specification for electronics bays and power supplies increases the availability of vendors offering competitive products. A wider base of products to select from provides greater flexibility in a make vs. buy decision. A system manufacturer can choose to develop or procure a mix of chassis, boards and power supplies that all work together minimizing system integration time and expense.

Common power supply specifications allow the industry to achieve manufacturing efficiencies and quality improvements based on volume production. Common electronics bays allow chassis suppliers to create off the shelf products which will accept off the shelf power supplies and server electronics based on the SSI specifications.

Benefits to Industry Suppliers:

The SSI specifications offer power supply, chassis and server board suppliers a wider range of potential customers. Suppliers can now develop products for broad industry application. This reduces the risk associated with development of custom products for specific customers. Time and cost expensed in repackaging technology to fit a customers unique format can be better spent on feature enhancement, quality improvement and manufacturing efficiencies. Suppliers can build competitive advantage based on volume production efficiencies of common server elements as compared to competition based on winning each new custom design.

Industry Status:

The SSI draft specification is in the hands of early reviewers and will be available to the wide industry soon. The draft specification will be the subject of a detailed session at the **Intel Developers' Forum (IDF)** (<http://developer.intel.com/design/idf>) Feb 17-19. Register now before time runs out.

Next Steps:

In the coming month the draft specification will be available on the web. From this site companies may download the latest draft and select contributor and/or adopter agreements. Please stay tuned to this page in Platform Solutions for an update on the location for draft specifications when they become available.

For More Information:

Please return to this Platform Solutions page for more information and web sites relating to the SSI initiative as they become available.

The SSI Initiative: Defining a Specification for Server System Infrastructure; Read the Top Story in Platform Solutions from Intel's GM of Entry/Mid-Range Server Division, Abhi Talwalker (<http://developer.intel.com/solutions/>)

Platforms: (continued)

Workstation Platforms

What's New

- **INTEL DELIVERS FASTEST PENTIUM® II PROCESSOR**; 333 MHz Pentium® II Processor
Enables High-Performance Visual Computing for volume workstations
(<http://www.intel.com/pressroom/archive/releases/dp012698.HTM>)
- Intel opens **new Application Solution Centers (ASC)**, labs dedicated to providing software development support to ISVs. Intel is now expanding the scope of ISV support by including OEM "franchise" ASCs.
- Intel supports **OpenMP forum**; Intel joined other computer hardware and software vendors to announce OpenMP
(<http://www.intel.com/businesscomputing/wrkstn/openmp.htm>)
- **New 64-Bit Processor** Will Extend the Intel Architecture for Workstations—
Joint Intel/HP 64-Bit Instruction Set Disclosed at the Microprocessor Forum
(<http://www.intel.com/pressroom/kits/events/mpf1097.htm>)

Overview

Workstations based on Intel microprocessors have been very competitive at the entry level of the workstation marketplace. They are now demonstrating their power in the midrange and beyond with the **Pentium® II processor** (<http://www.intel.com/businesscomputing/wrkstn/PentiumII/index.htm>) and **Pentium® Pro** (<http://www.intel.com/procs/ppro/wrkstn/index.htm>) microprocessor. That's good news for any company that wants great workstation performance and open system architecture benefits at a fraction of the cost of traditional workstation systems.

Workstation users demand levels of performance that, until recently, could be delivered only by vendors competing on the basis of proprietary, vertically integrated solution "stacks" with little cross-vendor compatibility. Now, that situation is changing. A generation of workstations built around either single or multiple Intel Pentium II or Pentium Pro processors extends the value economics of the PC industry into workstations.

Intel has assembled a team of workstation experts in its new Workstation Products Division (WPD) to supply building blocks, technologies and programs to OEMs, IHVs and software developers to accelerate the development of the Intel architecture workstation market. **System vendors** (http://www.intel.com/procs/ppro/wrkstn/wks_sys.htm) and applications providers alike have been quick to embrace the Pentium II processor's computational muscle and the maturity of Windows NT* for workstation use.

Standard Architecture

The biggest benefit of a single architecture that scales from personal computers to workstations is maximum access to the innovations in both. For users, the new workstation industry provides high-performance with outstanding price/performance. It also contributes significantly to lowering the total cost of ownership (TCO) of workstation computing. In essence, more space and convenience to engineering, lower cost-per-resource to management, lower support costs, and less need for duplicate equipment.

High-Performance

At the heart of the new workstation architecture is Intel's Pentium II processor introduced in May 1997. The Pentium II processor, now available in frequencies up to 333MHz, delivers the performance required for workstation applications. (For **performance info** please visit <http://www.intel.com/businesscomputing/wrkstn/PentiumII/perf/>)

Over the coming months you will continue to see exciting announcements in the area of workstation advancements based on the Intel architecture. These systems will possess all the key features you have come to expect from an engineering workstation, at an incredible price point:

- High-performance CPU
- Sophisticated 3-D graphics subsystems
- Built-in scalability
- Fast, highly expandable I/O, including advanced networking support
- Configurability to support hundreds of megabytes of RAM and terabytes of disk storage

At the October '97 Microprocessor Forum, Intel announced that the first member of its new family of 64-bit microprocessors, code named Merced™ processors, is scheduled for production in 1999.

The processor, still under development, will extend the Intel Architecture with new levels of performance and features for servers and workstations. In addition, Merced processors will be compatible with all the software that currently operates on 32-bit Intel processor-based workstations. For more information on IA-64™ processors and Merced, please visit the **Intel Microprocessor Forum site** (<http://www.intel.com/pressroom/kits/events/mpf1097.htm>).

Complete Solutions

A successful workstation is much more than a powerful processor. Intel is committed to continue working with other companies throughout the industry to ensure that all the technologies and products are in place to deliver optimal workstation solutions based on the Intel architecture.

For more information about **Intel Architecture based workstations**, please visit Intel's Workstation web site (<http://www.intel.com/businesscomputing/wrkstrn/index.htm>).

Technologies:

Microprocessor Technology

What's New:

- **INTEL DELIVERS FASTEST PENTIUM® II PROCESSOR**; 333 MHz Pentium® II Processor
Enables High-Performance Visual Computing for Businesses and Consumers
(<http://www.intel.com/pressroom/archive/releases/dp012698.HTM>)
- **NEW INTEL PENTIUM® PROCESSORS WITH MMX™ TECHNOLOGY BRING PERFORMANCE BOOST AND VALUE TO MOBILE PCs; New 266 MHz and 166 MHz speeds**
(<http://developer.intel.com/design/mobile/>)
- New Pentium II Processor **Developers Manual** Now Available
(<http://developer.intel.com/design/PentiumII/manuals/243502.htm>)
- Intel Identifies **Workaround** for the "Invalid Operand with Locked Compare Exchange 8Byte (CMPXCHG8B) Instruction" Erratum on the Pentium Processor
(<http://support.intel.com/support/processors/pentium/ppiie/index.htm>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The Pentium II processor is the most advanced Intel Architecture processor. Delivering Intel's highest performance on the three vectors of performance—floating point, integer, and multimedia—the Pentium II processor provides ample processing power needed in today's operating systems and new applications like those in business media, PC imaging, communications, and gaming.

The Pentium II processor family supports the evolution of computing technology in four important ways:

- 1) **Dual Independent Bus (DIB) architecture** (<http://www.intel.com/pentiumII/SPECS/dib.htm>)
- 2) **Dynamic Execution** (<http://www.intel.com/pentiumII/SPECS/dynamic.htm>)
- 3) **Intel MMX™ technology** (<http://www.intel.com/pentiumII/SPECS/mmx.htm>)
- 4) **Single Edge Contact (S.E.C.) cartridge** (<http://www.intel.com/pentiumII/SPECS/sec.htm>)

The Pentium II processor is available in 233MHz, 266 MHz, 300 MHz, and now 333 MHz versions for desktops, workstations and servers. Pentium II processors feature Intel's MMX technology to enhance multimedia and communications processing. They also use the high-performance Dual Independent Bus (DIB) architecture to deliver greater system bandwidth to complement their high processing power. The Single Edge Contact (S.E.C.) cartridge design includes a dedicated 512KB level two (L2) cache. The Pentium II processor also includes 32KB of level one (L1) cache (16K data, 16K instruction), twice that of the Pentium Pro processor. Error Correction Code (ECC) memory is now available on the L2 cache. This type of cache better enables servers and workstations to operate in business environments where data integrity and reliability are essential.

Intel plans to expand its Pentium II processor offerings in 1998 to power a variety of new platforms ranging from affordable Basic PCs (sub-\$1000 price points) to volume-priced Performance PCs, as well as Mobile PCs and volume to mid-range Servers and Workstations. Technologies on the horizon are 100 MHz system buses for Slot 1 processors that support new high speed SDRAM technology, and Slot 2 processors with 100 MHz system buses and optimized L2 cache configurations designed specifically for mid-range to high-end servers and workstations.

In 1999 Intel expects to be in production with the first member of a new family of IA-64™ processors, code named the Merced™ processor. This processor will be produced on Intel's 0.18 micron process technology, which is currently under development. The Merced processor will extend the Intel Architecture with new levels of performance and features for servers and workstations. Merced processors will be compatible with all the software that currently operates on 32-bit Intel processor-based machines. As IA-64 processors become established with the Merced processor, Intel will continue to expand its 32-bit product offerings. In 1999, Intel processors will span from 32-bit products for office, home and mobile users to the most powerful 64-bit products moving Intel into new, higher-end workstations and server market segments. For more information on IA-64 processors and Merced, please visit the **Intel Microprocessor Forum site** (<http://www.intel.com/pressroom/kits/events/mpf1097.htm>).

Benefits to Users:

Together, systems designed with the Pentium II processor and the **Accelerated Graphics Port (AGP)** (<http://developer.intel.com/solutions/tech/agp.htm>) make multimedia software come alive. Greater processing power and video bandwidth allow for better 3D graphics, richer textures, higher resolution, and smoother animation than ever before. All this provides a more lifelike experience for games, educational and hobby software. The Pentium II processor also enables new capabilities in PC imaging, video editing and playback, and audio re-mixing. Improved video performance means crisper and clearer images during video playback and editing. Pentium II processor-based systems bring home rich and exciting PC entertainment experiences with new media technologies like host-based **DVD** (<http://developer.intel.com/solutions/tech/dvd.htm>).

In business, Pentium II processor systems are available for desktop, server and workstation platforms. The Pentium II processor family is fully compatible with previous generations of Intel Architecture processors. Both small and large businesses benefit from optimal performance with applications running on advanced operating systems such as Windows* 95, Windows NT* and UNIX*.

With the advent of a new 100 MHz system bus, users will experience even higher overall system performance, allowing for expanded I/O operations based on higher speed communication with the system's SDRAM memory.

Benefits to Manufacturers:

Whether you're developing today's most advanced hardware platforms or leading-edge multimedia software, Intel's Pentium II processor brings you Intel's highest performance processor to date allowing you to offer increased performance and capability to business and consumer users. As the Pentium II processor architecture migrates into all market segments in 1998, hardware and software developers will be able to streamline their designs to one specification. To help you get your own products to market as quickly and reliably as possible, the **Pentium II Processor Developers web site** (<http://developer.intel.com/design/PentiumII>) offers up-to-the-minute technical information—from product and platform specifications, tools, design guidelines, technology tutorials, related products, and programming and manufacturing support. Check back often for new design information.

Industry Status:

Intel just announced the fastest Pentium II processor running at 333 MHz. Pentium II processor platforms for the business, consumer, workstation, and server market segments are all shipping today. In 1998 Intel will continue to bring higher performing 32-bit microprocessors, at speeds up to 450 MHz in various new configurations, with complementary platform building blocks to support further variations within these market segments. From Basic PCs, to Mobile PCs, as well as higher performing desktops, workstations and servers – all will benefit from the power of the Pentium II processor.

Intel's new family of 64-bit microprocessors, code named Merced™, scheduled for production in 1999, will bring new levels of performance and features to new, higher-end server and workstation market segments, while continuing to be fully compatible with today's applications running on the 32-bit Intel Architecture.

Stay tuned to this microprocessor technology page to get the latest information, as it becomes available.

Next Steps:

Developers - Base your next system design on the Pentium II processor. Whether it is a business desktop, workstation, consumer desktop, server, or mobile platform, the Pentium II processor is currently Intel's most advanced processor.

Don't miss the **Intel Developer Forum, February 17-19** (<http://developer.intel.com/design/idf>), to get detailed technical training on Intel Architecture processors (including IA-64™ processors) and complimentary platform technologies in all of the platform segments – Servers, Desktops, Workstations, and Mobile PCs.

For More Information:

Pentium II processor home page
(<http://www.intel.com/PentiumII/home.htm>)

Pentium II processor developer information
(<http://developer.intel.com/design/PentiumII/>)

Pentium II processor performance
(<http://www.intel.com/procs/perf/PentiumII/index.htm>)

Pentium II processor platform technologies
(<http://developer.intel.com/design/pentiumii/platform/index.htm>)

Intel's IA-64 processors and Merced processor information
(<http://www.intel.com/pressroom/kits/events/mpf1097.htm>)

Memory Technology

What's New:

- Intel Updates **100MHz SDRAM Specification** to Version 1.51 Available Today (<http://developer.intel.com/design/pcisets/memory/index.htm>)
- “**High Performance Memory Implementations**” technical track at the next **Intel Developer Forum on February 17-18**. Register today before space runs out. (<http://developer.intel.com/design/idf>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

Intel's goal is to ensure that memory subsystems continue to support evolving platform requirements through 1998 and beyond. Mainstream memory bandwidth requirements will be satisfied by EDO and 66MHz SDRAM performance through the first half of 1998. Intel is also working with memory vendors to keep up with the performance of faster processors and bus architectures. Intel has worked with leading DRAM vendors to anticipate this need by developing 100MHz PC SDRAM Component and DIMM specifications. In the second half of 1998, the industry will see an adoption of 100MHz SDRAM to complement new, faster Pentium® II processors. Beginning in 1999, the PC platform will be enhanced by Direct RDRAM to further enhance the interactive lifelike visual experiences on the standard PC platform, including workstation-quality 3D graphics and consumer-quality video.

Benefits to Users:

The emergence of 3D and video applications and the evolution of the PC **platform to the Visual Connected PC** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>) keeps evolving the PC architecture. New PC designs that will be based on faster Pentium II processors in mid-'98 are driving the need for ever-higher system memory bandwidth. Intel's leadership and industry participation are delivering new memory technologies which enable the development of higher performance PCs.

Benefits to PC Manufacturers:

Continuous work on PC SDRAM specifications helps PC manufacturers showcase platform performance and meet development targets for cost, availability and high-performance features. By working with the industry to develop PC SDRAM and DIMM specifications, Intel is helping to assure that memory products are built to support the next generation of platform requirements. Industry-wide compatibility helps PC OEMs line up multiple compatible DRAM suppliers to meet their cost and availability targets, while providing a high-quality product to PC end users.

Industry Status:

Intel's goal is to ensure that memory subsystems continue to support evolving platform requirements and to assure that memory does not become a bottleneck to system performance. It is especially important to assure that the PC memory roadmap evolves together with the performance roadmaps for the processors, I/O and graphics. To meet this goal, Intel has worked with leading DRAM vendors to develop 100MHz PC SDRAM Component and DIMM specifications that are **now available on Intel's developer web site** (<http://developer.intel.com/design/pcisets/memory/index.htm>). In addition, Intel participates in ongoing industry dialog to assure that memory suppliers get their technical questions answered.

Intel's role is to work with the memory industry to project future requirements, evaluate technology options, to help choose a path with adequate lead time and then to facilitate communication leading to a complete platform memory solution. This process achieved solid results beginning in 1994, with the introduction of PBSRAM technology for L2 cache. In 1994–1995, EDO DRAM was supported by the Intel 430FX PCIsset to achieve major performance improvements on the Pentium® processor. In 1996, the Intel 430VX PCIsset supported 66MHz EDO and SDRAM. Intel's newest chip set, the **Intel 440LX AGPset**

(<http://developer.intel.com/design/agpsets/440/index.htm>), supports current platform requirements with 66MHz SDRAM. Intel continues to support the memory industry with system-level simulation tools and design capability to assure OEMs and users have the right products at the right time.

The next step in the memory roadmap is Direct RDRAM. Intel and Rambus are working together to extend Rambus technology to meet PC platform memory requirements for 1999 and beyond.. On October 15, 1997 Rambus announced the details of its next-generation, high-speed memory interface. Developed in conjunction with Intel and in cooperation with other Rambus semiconductor partners, Direct Rambus technology is gaining broad industry support. More than a dozen DRAM companies, including the world's top 10 DRAM makers, have announced their intention to develop Direct RDRAM products. And in September, 18 companies representing the leaders in system-memory implementation products--including memory modules, connectors, clock chips and test systems--announced their intention to support Direct Rambus technology. Planned applications include computer system memory, multimedia and graphics memory, communications system memory and consumer electronics memory. For more details on the Rambus announcement please visit the **Rambus press release** (http://www.rambus.com/html/oct_15__1997.html).

Next steps:

Intel has delivered the PC SDRAM Component Specification, as well as the Serial Presence Detect and 100MHz DIMM specifications to major vendors and OEMs. These specifications are now available, and were updated in November 1997, on the Intel developer web site. They provide all the information needed to develop memory modules to support the latest Intel platforms through 1998.

The first Intel Developer Forum in September '97 focused on the tools and technical training necessary to implement the latest technologies. Intel provided a memory technologies track where its top architects discussed 100MHz SDRAM platform implementations for 1998, and Rambus was on hand to discuss Direct RDRAM for 1999. The next **Intel Developer Forum on February 17-19** (<http://developer.intel.com/design/idf>) will deliver the latest details on these memory technologies. Register today for the "High Performance Memory Implementations" track before it's too late.

For more information:

Revisit this page often for the latest details on Intel platform support services and future information on Direct RDRAM.

AGP Technology

What's new

- **“Maximizing AGP Performance”**; A New Intel White Paper
(<http://www.agpforum.org/downloads/guide2.pdf>)
- **AGP design flexibility** demonstrates feasibility of support for AGP soldered down on the motherboard as well as an unpopulated AGP connector
(see below in Industry Status - 2nd paragraph)
- AGP Interface **Specification, Revision 2.0** (preliminary draft) Now Available
(<http://www.intel.com/pc-supply/platform/agfxport/index.htm>)
- Register for the **February Intel Developer Forum (IDF)** Two Different Graphics Technical Tracks will be provided:
 - * *AGP 4X: Next Generation Graphics*
 - * *Understanding 3D Graphics and AGP Performance*(<http://developer.intel.com/design/idf>)
- Third **AGP Plugfest Coming** February 10-13, 1998 in Milpitas, California —Register Now!
(<http://www.agpforum.org>)
- **“AGP Done Right”**; Intel's Director of Chip set Engineering, Richard Malinowski, describes why AGP and the Pentium® II processor represent the best AGP implementation, from PSN issue#4
(<http://developer.intel.com/solutions/archive/issue4/stories/top1.htm>)
- Intel Announces **IPEAK Family of Performance Analysis Tools**, including a tool for Graphics and AGP Performance Analysis
(<http://developer.intel.com/design/ipeak/>)
- Industry Status (below)
- Next Steps (below)

Technology description

The Accelerated Graphics Port (AGP) is a dedicated interface on the PC platform that enables high-performance graphics and full-motion video on mainstream PCs. The AGP interface, positioned between the PC's chip set and graphics controller, significantly increases the bandwidth available to a graphics accelerator (current peak bandwidth of 528 MB/s). It also helps to alleviate the cost pressure associated with a growing need for large and expensive dedicated graphics memories by leveraging a PC's main memory, in addition to local graphics memory.

By leveraging main memory, Independent Software Vendors (ISVs) are no longer constrained by the amount of dedicated local graphics memory in limiting the visual quality of their applications. Using main memory as if it were an extension of the dedicated local graphics memory, ISVs have significantly more storage space available for graphics data, which permits a significant increase in visual quality. Not only does AGP improve 3D graphics, but its increased bandwidth is a key enabler for full-motion video on the PC, such as host-based software MPEG-2 playback (DVD).

AGP lays a scalable foundation for high-performance graphics—future systems will support an AGP peak bandwidth over 1GB/s. An AGP enabled system requires an AGP-compatible: graphics accelerator chip or add-in card, chip set, BIOS, and motherboard. The AGP specification, which has been led by Intel and made available to the industry, is a key building block for Intel's **Visual Computing Initiative** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>).

Benefits to users

Merely delivering an AGP compatible product in a PC is not good enough to meet the demands of today's savvy PC purchasers. Enabling high-performance graphics for developers, as well as for PC users, requires significant planning to eliminate "weak links" in other parts of a PC system. With the Pentium® II processor and its Dual Independent Bus (DIB) architecture, Intel has proactively taken steps to "raise the bar" in terms of performance for other parts of the PC system. First, the extremely powerful floating-point performance of the Pentium II processor is the foundation for high-performance graphics. This permits ISVs to develop a new class of applications that can deliver life-like experiences to PC users. Second, the Pentium II processor's integrated L2 cache within the Single Edge Contact Cartridge permits the L2 cache frequency and performance to scale with the higher frequency CPUs that Intel will be delivering throughout 1998. A significant weakness of a Socket-7 AGP implementation is that the L2 cache performance does not scale with the CPU. Third, the DIB architecture allows the Pentium II processor to be performing 3D calculations while at the same time an AGP graphics accelerator can be performing AGP Texturing (i.e., directly executing textures from main memory). Doing this work in parallel is in part delivered by **Intel's 440LX AGPset** (<http://developer.intel.com/design/agpsets/440/index.htm>), which can be found in today's Pentium II processor based systems at mainstream price points. Again, the lack of this concurrency is another weakness of a Socket-7 AGP implementation.

Some of the first applications optimized for AGP are beginning to show up on store shelves. For example, Psygnosis' G-Police, a flight simulation title that is set in a Bladerunner-like future, is now available. The AGP-enabled version of G-Police provides richer backgrounds, more spectacular special effects, and even uses full-motion video textures on city billboards within the application.

In addition to arcade-quality 3D games, consumers can expect entirely new classes of applications to be enabled by AGP, such as 3D reference works and interactive video titles. Business users will also see new types of applications resulting from AGP, such as 3D visualization and interactive 3D web applications.

Here is just a sample of some applications that are being optimized to take advantage of the benefits of AGP. Some of these applications have already started showing up on store shelves, and others will arrive in early 1998 and throughout the year. (A few of these applications are still in early development):

<u>Application*</u>	<u>Developer*</u>	<u>Publisher*</u>	<u>Category</u>
G-Police	Psygnosis	Psygnosis	Flight simulation
Red Line Racer	Criterion Studios	Ubi Soft Entertainment	Motorcycle racing
Tonic Trouble	Ubi Soft Entertainment	Ubi Soft Entertainment	Kids action/adventure
Eyewitness Virtual	DK Multimedia	DK Multimedia	Education/refer—DVD
O-Zone	Pixel	Electronic Arts	Online action game
F22: Air Dominance	Digital Image Design	Ocean-Infogames	Flight simulation
Beyond the 3 rd Dimen.	Davidson and Assoc.	CUC	Kids education/game
Tex Murphy: Overseer	Access Software	Access Software	Detective game—DVD
ConceptCAD	Virtus Corporation	Virtus Corporation	3D Visualization

Here are some Internet URLs for some of the AGP software developers listed above:

Psygnosis = www.psygnosis.com
 Criterion Studios = www.csl.com
 Ubi Soft Entertainment = www.ubisoft.com
 Pixel = www.pixelmm.com
 Electronic Arts = www.ea.com
 Digital Image Design = www.did.com
 DK Multimedia = www.dk.com
 Access Software = www.accesssoftware.com
 Davidson and Associates = www.davd.com
 Virtus Corporation = www.virtus.com

Benefits to manufacturers

One of the benefits of Intel re-doubling its efforts to deliver Pentium II processors to meet the needs of PC OEMs and the marketplace in general, is that AGP will find its way into systems priced very aggressively in the second half of '98. In fact, it is anticipated that a Pentium II processor system with AGP will be part of the Basic Desktop PC in the second half of '98. This eliminates the short-term cost benefits others thought might exist for a Socket-7 AGP implementation. Also note that Intel has designed and delivered a software patch (AGP VxD) to support all of the AGP benefits on Windows* 95—you can deliver all of the AGP benefits for your customers today. Finally, taking graphics off of PCI and putting it on AGP does not address the other weaknesses of a Socket-7 AGP implementation; that is, it still does not address the L2 cache inefficiencies or the bottleneck in getting to main memory. In fact, if one starts storing texture maps in main memory (which is one of the cost savings benefits of AGP) on a Socket-7 AGP implementation, it may make the main memory bottleneck even worse.

AGP takes PCs to a new level of performance. Exciting arcade-quality games and new classes of applications promise to grow the overall market for PCs, peripherals, and Software. By providing a dedicated, high-speed connection between the graphics controller and main memory that matches the processing power of the Pentium II processor, AGP balances the overall performance of the Intel Architecture PC platform. PC OEMs can build systems that more fully realize the potential of the Pentium II processor, and graphics Independent Hardware Vendors (IHVs) can build products that are no longer constrained by the limited bandwidth of the PCI bus. AGP is a scalable solution designed so that graphics performance will improve with performance increases of the Pentium II processor.

Industry status

Intel has written a *Maximizing AGP Performance* whitepaper and published it on the AGP Implementors' Forum website (<http://www.agpforum.org>). This paper presents usage guidelines for maximizing AGP bandwidth. The paper is organized into three main sections: Data Movement, AGP Performance, and Guidelines. The first section relates platform data movement to the three different modes used to move data over AGP. The next section describes the features of each mode, and explains how these features influence the mode's performance. The last section presents guidelines for each mode along with data justifying the guidelines and examples showing the importance of following the guidelines. This paper focuses on AGP Interface Specification Rev. 1.0 performance.

In August 1996, Intel introduced the Accelerated Graphics Port (AGP) Interface Specification Rev. 1.0. The specification included information on how to design AGP products for PCs. The AGP specification only allowed for a single AGP device. This meant that the AGP device could either be soldered "down" on the motherboard or supported "up" by an AGP connector. The latter alternative enables PC manufacturers or PC users to use a variety of AGP graphics cards. However, the specification did not provide for similar flexibility in systems that used graphics "down." In an effort to support PC OEM demand and increase AGP flexibility, Intel has developed a solution that will permit an AGP alternative for those systems that were designed with AGP graphics "down." Intel has posted an ECR for AGP Rev. 1.0, and has included similar information on page 25 of the Preliminary Draft of AGP Rev. 2.0 (which is located at <http://www.intel.com/pc-supp/platform/agfxport/index.htm>). While this new, more flexible approach will provide more options for connecting AGP devices, the specification will still allow the use of only one AGP device in each system at any given time. This specification change increases AGP design flexibility, although the solution space for the change is narrow and design implementation will require extensive simulation, testing and analysis. It is the responsibility of the PC OEM to do the extensive design, layout, and validation of each and every combination of chipset/graphics/motherboard to ensure interoperability of an upgrade solution within the specification. In short, an OEM can design a motherboard that has an AGP device soldered down on the motherboard as well as include an unpopulated AGP connector.

The *Preliminary Draft of the Accelerated Graphics Port Interface Specification Rev. 2.0* is now available on the internet (<http://www.intel.com/pc-supp/platform/agfxport/index.htm>). This specification includes the AGP 4X enhancements, in addition to incorporating the Engineering Change Requests (ECRs) from the earlier Rev. 1.0 specification. At the next **Intel Developer Forum (IDF)** on February 17-19, Intel will be devoting one of the technical tracks to AGP 4X (*Track Title—AGP 4X: Next Generation Graphics*). This track will provide an overview of the AGP 2.0 specification including the thought

processes that led to some of the developments and details of changes from the AGP 1.0 specification. Sessions during the day will discuss AGP 4X logic and electrical considerations, technology capabilities and implementation alternatives, packaging and board requirements for 4 and 6 layer designs, and AGP upgradability. There will be a separate track titled *Understanding 3D Graphics and AGP Performance*. Both of these tracks are an invaluable opportunity to learn from and meet some of Intel's architects and engineers that are doing excellent work in and around 3D graphics and AGP. For details please visit the **IDF web site** (<http://developer.intel.com/design/idf>).

Intel continues with the development of its **Intel Performance and Evaluation Kit (IPEAK)** tools for graphics. The intent of these tools is to provide a very useful family of platform performance and integration tools to the industry to enable development of higher performance and more robust products with a quicker time-to-market. Although the final tools are targeted to be available in Q1'98, you can join the beta program today. The IPEAK Graphics Toolkit currently consists of two tools that help OEMs and IHVs analyze and improve the performance of their graphics solutions. First, The Graphics Performance Toolkit provides a better understanding of the performance issues and limitations related to graphics hardware and applications. Second, the Baseline AGP System Evaluation Suite is a system integration and validation tool that provides the capability to test and evaluate AGP system-level functionality and utilization. (For further details please visit the **IPEAK web site** -- <http://developer.intel.com/design/ipeak/>).

You are invited to attend the **AGP Plugfest** in Milpitas, California, February 10–13, 1998. Due to the great attendance at the last AGP Plugfest in Taiwan, the testing schedule has been extended. The Plugfest is an interoperability event intended to bring together manufacturers of AGP graphics controllers, graphics cards, motherboards and system OEMs to test card and system compatibility. The Plugfest includes several training sessions to explain test methodology and highlight what's new with AGP. Testing sessions are private, one hour per OEM. The tests are designed to validate hardware and software functionality in a noncompetitive environment. Additional test teams will be available to validate electrical and mechanical specs and BIOS settings. A suite will be available for on-site debugging. For more information about the Plugfest, including AGP Implementors' Forum Membership, registration and hotel information, please visit the **AGP IF web site** (<http://www.agpforum.org>). Please note that you must be a member of the AGP Implementors' Forum to attend.

Next steps

PC OEMs—When delivering high-performance PCs to your customers be sure to choose the Intel Pentium II processor and the Intel 440LX AGPset. This powerful combination will provide the necessary horsepower to meet your customers' expectations for high-performance graphics (e.g., extremely powerful floating-point performance, DIB, etc.).

Graphics Chip and Card Vendors—Design your second-generation AGP products to support the high-performance AGP features (e.g., SideBand Addressing, Pipelining, AGP 2X, etc.). Be sure to proactively design in support for AGP Texturing, in addition to Local Texturing.

Software Developers—Now is the time to develop exciting new applications that take advantage of AGP technology. Create applications with rich, lifelike textures to take advantage of the many AGP enabled PC systems and cards entering the market in the second half of '97 and throughout 1998. Take advantage of the AGP capability to use main memory as an extension to the local graphics memory (i.e., AGP Texturing).

For More Information

Visit Intel's AGP web site to **download** the *Preliminary Draft of the Accelerated Graphics Port Interface Specification Rev. 2.0*, which includes the AGP 4X enhancements. (<http://www.intel.com/pc-supply/platform/agfxport/index.htm>)

Visit Intel's **AGP home page** for more detailed information on AGP and a tutorial explaining AGP functionality at the system level. (<http://developer.intel.com/technology/agp/index.htm>)

Visit the **AGP Implementors Forum home page** for more development, product, and event information, including registration details for the next AGP Plugfest and helpful design guides. (<http://www.agpforum.org>)

Visit **IPEAK web site** for more information on Intel's IPEAK Graphics Toolkit. Join the beta program today, with final tools targeted for the first quarter in '98. (<http://developer.intel.com/design/ipeak/>)

DVD Technology

What's New:

- New White Paper Available - **DVD Video Playback Primer**
(<http://developer.intel.com/solutions/tech/dvd/dvdrp10.pdf>)
- Download the **new DVD white papers** provided at the DVD Developer Conference in October'97:
(<http://developer.intel.com/solutions/tech/dvd.htm>)
 - * **MCI recommended command set** for DVD title development under Windows* 95
 - * **DVD interactivity white paper** showing transition of MCI commands to DirectShow*
- Read the top story in Issue #3 of *Platform Solutions* on "**Host-based DVD: Arriving on PC Platforms Today**," by Rajesh Shakkarwar, Intel's DVD Technology Development Manager
(<http://developer.intel.com/solutions/archive/issue3/stories/top5.htm>)
- Download the **DVD white papers** provided at the Intel Developer Forum on September 29:
(<http://developer.intel.com/solutions/tech/dvd.htm>)
 - * Copy Protection Licensing Requirements for the **CSS DVD Method**
 - * **Tamper Resistant Software: An Implementation**
 - * Implementation of a **High-Quality Dolby* Digital Decoder** Using MMX™Technology
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

DVD is a new optical storage technology that stores digital information on discs which are similar in size and appearance to CD-ROMs. DVD discs can contain a combination of audio, video, and computer data, and have been designed for use in both the home entertainment and PC environments. By using 50% smaller "pits" to hold data, a DVD disc can currently hold seven times as much information as a conventional CD-ROM. Future DVD discs will be double sided and double layered, allowing four times again as much data to be stored (up to 17GB).

DVD technology has been under development for several years, and five different variations have arisen to meet the needs of different types of users:

- **DVD-Video**—Read-only storage intended for the playback of entertainment content, such as movies, on consumer DVD players connected to a TV or on DVD drives in a PC.
- **DVD-ROM**—Read-only storage intended for PCs. Essentially a much larger CD-ROM. Can store video, audio, images and graphics in any format. Ideal for interactive software such as games, reference materials and other data intensive applications.
- **DVD-R (Recordable)** - Write-once, read-many storage. The target usage model includes archiving, software development and low-volume data distribution.
- **DVD-RAM**—Write many, read many storage. Example applications include short-term archiving, software development and media recording.
- **DVD-Audio**—This format focuses on music and other forms of audio-only content. A number of technical issues remain to be resolved, including encoding and copy protection.

Consumer electronics companies are currently producing DVD-Video players to be used primarily for playing movies on televisions. PC-based DVD playback, however, can support all of the DVD formats ushering in a broader array of applications, including interactive titles, archiving and movies. PC DVD drives are also backwards compatible and will play existing CD-ROM titles and CD audio recordings.

DVD-ROM titles for the PC can be encoded in a variety of different formats (e.g., Indeo[®] video, MPEG1, MPEG2, Cinepak*), whereas DVD-Video titles for home entertainment are generally restricted to MPEG2 video and AC-3 or Linear PCM audio. The range of encoding formats on PC DVD lends itself to flexible solutions which perform decoding in software rather than with dedicated hardware. PCs based on Intel's Pentium[®] II processor are especially well-suited for software, or host-based, playback of DVD content utilizing the power of the microprocessor instead of costly add-in hardware.

Due to the ease with which digital content can be replicated, copy protection has been an important issue in the development of DVD technology. Intel has worked closely with Hollywood studios and the electronics industry to define copy protection solutions that are suitable for both the consumer electronics and PC industry. Intel has made available a copy protection CSS white paper at the top of this page.

Benefits To Users:

DVD promises to offer consumers a new level of **visual computing**

(<http://developer.intel.com/solutions/archive/issue1/focus.htm>) experience on their PCs. Users can come to expect the following benefits from DVD technology:

- *Huge storage capacity* - Today's applications requiring multiple CD-ROMs (e.g., *WingCommander II**) can be consolidated onto a single DVD-ROM disc.
- *Incredible quality* - With DVD, consumers will be able to experience theater-quality video and audio on their PC.
- *Rich interactivity* - The large capacity of DVDs combined with the processing power of the PC will enable software vendors to create applications that provide visually rich, interactive experiences for end-users.
- *Convergence* - DVD video discs will play on both set-top players and PCs.
- *Backward compatibility* - DVD drives can play existing audio CDs and CD-ROMs.

Benefits To Manufacturers:

DVD technology promises to benefit a wide array of industries and companies. PC OEMs will be able to deliver a more interactive and media-rich experience to end users. Solutions that use both dedicated hardware for playback, as well as host-based software playback, on PCs are already available today. Software providers will be able to create new titles that integrate full-motion video, high-quality audio, graphics and images. In the near term, they can consolidate multi-CD titles onto a single DVD. Drive manufacturers stand to see increased business as the momentum behind DVD builds and sales of PC DVD drives explode. CD drive and disc manufacturers can leverage their existing manufacturing technology to make DVD products.

Industry Status:

All major consumer electronics companies have released or announced DVD-Video players. Moreover, most major Hollywood studios support the medium and have begun releasing movies on DVD. At least 150 titles are shipping today and over 350 titles are in development. In the PC market, the first DVD-ROM drives for computers began shipping in April of this year. PC OEMs are integrating DVD drives into their product lines today. Higher-end solutions will rely on hardware solutions for de-scrambling and decoding functions, but a few OEMs have already announced host-based solutions that utilize the Pentium II processor. The more cost-effective host-based DVD playback solution on Pentium II processor-based platforms will allow DVD on the PC to reach mainstream price points by the second half of 1998. In addition, the software industry is making a concerted move to DVD-ROM, with over 50 interactive titles in development. The DVD-R and DVD-RAM specifications are complete but products are not yet available. Recently, several companies (Sony*, Phillips*, and Hewlett-Packard*) have announced an alternative format to DVD-RAM called DVD+RW. The DVD-Audio specification is still under development and products are not expected until 1999.

Intel has been working with the PC and consumer electronics industries on DVD technology diffusion for over two years. **Intel and the Software Publishers Association hosted a DVD Developer Conference** on October 29, providing development guidelines, tools and solutions to bring more compatible DVD interactive titles to PCs. The conference was a success with over 220 attendees from a variety of industries hearing presentations from Intel, the SPA and others involved in DVD technology development. Also provided was a product showcase, a DVD developers case study, and product compatibility testing with 20+ software/content developers. Daikin* announced the first Intel Architecture-

based Windows NT* DVD authoring tool as an important step in bringing low-cost authoring to a larger customer base. And two important new white papers were provided by Intel and the SPA to enable compatible DVD interactive title development in support of MCI and DirectShow*:

- **MCI recommended command set** for DVD title development under Windows* 95
- **DVD interactivity white paper** showing transition of MCI commands to DirectShow

To view some of the presentations given at the DVD Developer Conference, please visit the **SPA web site** (<http://www.spa.org/dvd/oct.htm>).

Intel also hosted the first **Intel Developer Forum (IDF)** on September 29, providing a day-long training track for OEMs and IHVs on implementing host-based DVD playback on Pentium II processor-based PC platforms. The next **Intel Developer Forum on February 17-19** (<http://developer.intel.com/design/idf>) will provide the latest details in the "Host-based DVD" track, directly from Intel's top architects. Register today before it's too late.

Next Steps:

- **PC OEMs** - Download the new DVD white papers from the DVD Developers Conference and the Intel Developer Forum and become familiar with DVD implementation. Begin to include DVD hardware in your PC designs and start preparing for host-based DVD in your platform designs for 1998.
- **Software Developers** - Download the new DVD white papers provided at the DVD Developers Conference and the Intel Developer Forum to ease development of compatible interactive titles for the PC. Start porting multi-CD titles to DVD-ROM. More importantly, begin developing new titles that incorporate full-motion video, high-quality audio, images and 3D graphics. Visit Intel's DVD Authoring Studio for assistance with getting your title on DVD.
- **Studios** - Continue the transition to the DVD format. Expand the collection of titles on DVD.

For More Information:

Understand DVD's role as a key ingredient of the **PC 98 System Design Guide** (<http://developer.intel.com/design/PC98/index.htm>).

Intel's DVD Authoring Studio in Hillsboro, Oregon, provides independent software vendors with access to a state-of-the-art DVD authoring facility that allows them to do software layout, testing and pre-mastering of DVD content (http://developer.intel.com/drg/hybrid_author/DEVLAB.HTM).

The **DVD FAQ** is a good source of more detailed information about DVD (<http://www.videodiscovery.com/vdyweb/dvd/dvdfaq.html>).

One stop shopping for DVD information on the web (<http://www.unik.no/%7Erobert/hifi/dvd/>).

Software Publishers Association information on DVD-ROM (<http://www.spa.org/dvd/default.htm>).

MPEG Organization DVD Resources (<http://www.mpeg.org/~tristan/MPEG/dvd.html>).

DVD and Microsoft* O/S web site (<http://www.microsoft.com/hwdev/devdes/dvdwp.htm>). Stay tuned to this Platform Solutions DVD technology page for the latest news about DVD on the PC platform.

Audio Technology

What's New:

- **Design High-Quality Audio at Lower Cost** with Audio Codec '97 Version 2.0, Platform Solutions Issue #4 top story by Intel Audio Marketing Manager, Russ Hampsten (<http://developer.intel.com/solutions/archive/issue4/stories/top4.htm>)
- Intel Announces **version 2.0 of Audio Codec '97** (AC '97) specification (<http://developer.intel.com/pc-supply/platform/ac97/>)
- **Audio 98 Roadmap** Available for Download (<http://developer.intel.com/pc-supply/platform/aud98/audio98.htm>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

Increasing processor performance, integration of functionality and external expansion buses are among the major trends currently transforming PC audio. As processor performance increases, more functionality is accomplished in software. This is an industry-wide trend and can be observed across all platforms and CPUs. Hardware faces competition with software-only implementations and needs to demonstrate a functionality, performance or quality advantage. However, for high-performance 3D computing and gaming platforms, hardware acceleration will continue to be desirable. As the attach rate for a function goes up there is more incentive for integration onto the system motherboard or even into the Super-I/O or chip set logic. This is also an observable industry trend. External expansion buses offer PC OEMs system design and configuration flexibility, and offer PC customers user-friendly upgrades.

The gradual replacement of ISA add-in cards with **USB**

(<http://developer.intel.com/solutions/tech/usb.htm>) is under way, and **IEEE 1394**

(<http://developer.intel.com/solutions/tech/1394.htm>) is also expected to gain momentum within the next couple of years. The transition to external digital audio is expected to be gradual because initial implementations will probably appear first at the mid- to high-end PCs and cost more than highly integrated motherboard audio solutions. Intel is providing the industry with recommendations and supporting data on hardware vs. software partitioning. Intel is very involved in each of these areas and the **Audio '98 roadmap document** (<http://developer.intel.com/pc-supply/platform/aud98/audio98.htm>) helps clarify the transitions and what the industry is doing for 1998.

Benefits to Users:

The main benefit to users is that they will get much higher quality audio solutions with several key new features that have not been possible before. 3D positional audio will bring new levels of realism to games with sounds being positioned interactively around the user, making them truly part of the 3D virtual experience. The user will also get much better music reproduction with MIDI utilizing Wavetable synthesis.

Benefits to Manufacturers:

Audio has become a very important and highly visible part of today's PC experience. With the arrival of very high quality built-in audio components and external digital connectivity, the quality of the PC audio experience will rapidly become a function of the PC customer's budget for audio peripherals. The growing diversity of PC audio requirements, platform segments, and buses forces all industry players to acknowledge that there is more than one right way to implement audio. Upcoming operating system releases are expected to fully support external digital audio peripherals and emerging digital consumer electronics connections, increasing system flexibility and scalability on the high end. By 1998, Intel expects digital extensions to the baseline system audio will emerge based on USB and IEEE 1394 specifications: USB for PC audio peripherals, and IEEE 1394 for connections to digital CE. AC '97, USB,

and 1394 should be viewed as overlapping yet complementary specifications that provide OEMs with more opportunities to address a wider range of platform implementations. Intel expects that the majority of PCs in 2H98 will support analog connectivity. But in the end, it is the PC OEM who is in the best position to determine whether a SoundBlaster* compatible, Digital-Ready, or Digital-Only audio solution satisfies the customer's needs.

Industry Status:

Intel worked with the industry to develop the original AC '97 specification in 1996. Many new audio products are now shipping that support AC '97. PCI (AC '97) audio products will be shipping in volume in the first half of 1998 time frame. With the introduction of Windows* 98 and WDM audio, USB audio devices will be enabled and shipping. The audio quality that AC '97 provides is a key enabler of **DVD** (<http://developer.intel.com/solutions/tech/dvd.htm>) content, as well as software-driven three dimensional audio technologies such as Intel's recently announced Realistic 3D Sound Experience (RSX) technology. Based on extensive feedback from leading industry audio chip and peripheral vendors, and PC manufacturers, the Audio '98 roadmap highlights the technical ingredients to deliver audiophile-quality audio to the PC.

At the Intel Developer Forum (IDF) in September Intel released a version 2.0 update to the Audio Codec '97 specification. The new spec is intended to augment the existing AC '97 version 1.03 specification rather than replace it. AC '97 rev. 2.0 defines new extensions supporting high-quality audio (like that from DVD), and extensions for modem and docking to help both desktop and mobile manufacturers adopt these features more quickly and cost-effectively. The specification can be downloaded from the Intel developer **AC '97 web site** (<http://developer.intel.com/pc-supp/platform/ac97/>).

At IDF Intel also discussed the implications of audio implementations with the PC 98 System Design Guide. IDF presentations from Intel's top architects for the PC 98 training tracks are available on **Intel's PC 98 web site** (<http://developer.intel.com/design/pc98/#IDF>).

Next Steps:

OEMs and IHVs: The time has come to start moving away from Legacy ISA audio to new PCI/AC '97 audio for the new features that it will only be able to deliver. All 1H'98 products should support AC '97.

E-mail Audio97@intel.com to add your name to the Audio '97 mailing list to receive periodic updates.

Come back to the Audio technology *Platform Solutions* news page for future information on AC '97 and Audio 98.

Don't miss the **next Intel Developer Forum on February 17-19**. Register at the **IDF web site today** (<http://developer.intel.com/design/idf/>)

For More Information:

For more background information (white papers and specifications) go to **Intel's AC '97 web site** (<http://developer.intel.com/pc-supp/platform/ac97/>).

For technical presentations on audio and other PC 98 training tracks from the September '97 Intel Developer forum visit the **PC 98 site** at (<http://developer.intel.com/design/pc98/#IDF>).

For more information on the **Audio '98 Roadmap** go to (<http://developer.intel.com/pc-supp/platform/aud98/index.htm>).

For more information on USB Audio, download the **USB Audio Application Note** (<http://www.intel.com/design/usb/applnots/292206.htm>).

USB Technology

What's New:

- New "External Interconnect Technologies" technical track to discuss USB and 1394 implementation at the **February Intel Developer Forum**. Register now before it's too late.
(<http://developer.intel.com/design/idf>)
- New **USB Products Arriving on the Market**
(http://developer.intel.com/design/usb/new_pcs.htm)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

Universal Serial Bus (USB) is the easier to use and flexible interconnect specification that enables instant "outside the box" Plug and Play peripheral connectivity. It allows users to add peripheral devices without expensive add-in cards or configuration headaches such as DIP switches and IRQ settings. A single connector type simplifies connection of all USB-compliant devices, including telephony and broadband adaptors, video phones, digital cameras, scanners and monitors in addition to joysticks, keyboards and other I/O peripherals. USB's hot attach/detach capability lets users add and remove devices without turning off their PC. USB also distributes power to peripheral devices and employs a hub architecture that allows multiple different devices to be connected simultaneously.

USB is a key enabling technology for emerging PC initiatives including PC Imaging and Computer Telephony Integration (CTI). Moreover, the connectivity needed **to support Intel's Visual Computing Initiative** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>) may now be attained without the need for add-in card solutions.

For more details, visit **Intel's USB home page** (<http://www.intel.com/design/usb/>).

Benefits to Users:

USB expands the PC experience by enabling a new dimension of configuration freedom and interactivity. The absence of add-in cards and power supplies also helps reduce overall system cost. USB is easier to use and allows users to instantly reconfigure their systems "on the fly" by plugging and unplugging devices. Because USB enables both isochronous and asynchronous data transfers, it has the capacity to enrich the user's ability to control peripherals, such as audio speakers, from the PC. The ease of device sharing makes PCs more manageable for users of home and business PCs.

Benefits to Manufacturers:

USB is an open, royalty-free specification which has received broad industry acceptance. USB's ease of use and relatively low cost are expected to support the continued expansion of the PC peripherals market into new and fast-growing areas such as digital imaging, integrated telephony and interactive multi-player games. Absence of add-in cards and, in many cases, external power supplies also simplifies product design and helps reduce costs. Fast time-to-market development solutions are available now from Intel and other suppliers.

Industry Status:

USB technology is in full-swing implementation. Most new PCs introduced in 1997 are shipping with live USB ports, ready to connect to USB-compliant devices. Many USB devices are now arriving on the market, and hundreds of USB peripheral products are slated for release in 1998.

Intel has announced the new single-chip 8x931Hx Universal Serial Bus (USB) hub controller and the new 8x931Ax USB hubless controller to complement the Intel family of integrated USB products. Hub monitors play a central role in implementing the virtually unlimited peripheral connectivity potential of

USB. Intel expects the demand for "smart" USB hub monitors on Windows* 95 platforms to grow as users experience the benefits of USB. Intel is helping developers prepare with a comprehensive one-stop solution that includes a Win32 Driver Model monitor driver, USB Monitor class and Human Interface Device (HID) class-compliant APIs, an On-Screen Display (OSD) applet, Intel 8x931 and 8x930 USB hub controllers and HID-compliant firmware, Intel 8x931 and 8x930 USB hub reference board hardware schematics and application notes.

Intel also offers assistance for developers in the areas of systems integration and validation testing through its Peripheral Integration Laboratories and Systems Integration and Validation (SIV) program.

The **Intel Developer Forum on February 17-19** will have a technical track titled "External Interconnect Technologies" which will provide an update to USB with emphasis on understanding system integration issues and compliance requirements including the proposed USB specification update version 1.1. Learnings from USB applied to 1394 implementation on the PC will also be discussed.. For details , please visit **the IDF site** (<http://developer.intel.com/design/idf>)

Next Steps:

Peripheral Developers—Once they get their hands on USB, PC users may never let go. Now is the time to develop USB-compliant products, so you will be ready to meet this growing level of consumer awareness. Register for the Intel Developer Forum - External Interconnect Technologies track.

System Developers—Designing with PCIs that support USB and the OEM release of Windows* 95 will help position you to meet the emerging consumer demand for "device-ready" USB-compliant PCs. Be sure to visit Intel's USB home page and the USB Implementers Forum home page for the design information, developer support and product information you need. Register for the Intel Developer Forum - External Interconnect Technologies track.

For More Information:

Q&A with Intel's USB experts, Steve Whalley and Bala Cadambi, in Issue 1 of *Platform Solutions* (<http://developer.intel.com/solutions/archive/issue1/stories/USB.htm>).

See Intel's USB home page for the **latest developer resources and design tools** (<http://www.intel.com/design/usb/>).

Visit the USB Implementers Forum home page for information **on development support, products and events** (<http://www.usb.org>).

1394 Technology

What's New:

- New **White Paper on Protocol enhancements in 1394a**
(<http://developer.intel.com/solutions/tech/xtra/1394wp95.pdf>)
- Revision 1.0 of the **1394 Open Host Controller Interface (OHCI) specification** was released to the industry. You can download it today.
(<ftp://www.austin.ibm.com/pub/chrptech/1394ohci/>).
- Intel delivers **keynote at the October 1394 Trade Association meeting** in Phoenix, Arizona. Jim Pappas, Director of Technology Initiatives at Intel, outlined the role 1394 will play in the future of the PC. **Download the presentation at.**
(<http://developer.intel.com/solutions/tech/xtra/keynote.pdf>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

IEEE 1394 is a video-speed serial interconnect that is now an IEEE standard. Like USB, 1394 enables plug-and-play peripheral connectivity, provides power to peripherals helping to eliminate each one having its own power supply, and supports isochronous data transfers. 1394, however, takes these capabilities to video speeds. USB and 1394 serve different needs which will coexist for the foreseeable future. Peripherals that do not require the high data transfer rates possible with 1394 will remain with USB. Eventually, PCs will need only USB and 1394 serial ports to handle all I/O, dramatically simplifying life for PC users.

The consumer electronics industry is already shipping digital camcorders, digital satellite receivers and digital VCRs all with 1394 interfaces. 1394 is the physical bridge that makes the convergence of consumer electronics and PCs possible. Existing products support 1394 protocols at 100 and 200 Mbps, with 400 Mbps products shipping in 1998. The 1394 road map extends to speeds at 800, 1600 and 3200 Mbps.

1394 also provides the storage industry with a PC interconnect to follow on IDE and the printer industry to replace the parallel port. Because 1394 can handle very high data rates, it encourages peripherals to transmit more "raw" data to the PC for host-based processing, which can significantly reduce the cost of some peripherals like digital still cameras. 1394 is important not only for connectivity to new digital consumer electronics devices, but also for core PC peripherals as they move to higher data rates. A 1394 scanner, for example, would be appreciably faster than a parallel port scanner, especially at higher resolutions.

In conjunction with USB, 1394 makes possible new "modular" approaches to PC architecture with the modules tied together with two serial buses. The proposed **Device Bay Specification** (<http://www.device-bay.org/>) is an excellent example of the great new applications enabled by 1394 (and USB), in this case providing peripheral modularity.

Benefits to Users:

One promise of 1394 is a significantly enriched PC user experience. Users will be able to use their PCs to control consumer electronics and PC peripherals, edit audio/video content, link peripherals to the Internet, and much more. 1394 will bring the PC to the family room to provide entertainment, gaming, and learning experiences not possible today.

Modular PCs will allow users to buy as little or as much PC as they like and to upgrade their PCs selectively, at will and painlessly. A PC system becomes more like a component stereo system, with

1394 playing the role of a digital RCA connector. 1394 could permit corporate information technology departments direct control over all users' peripherals for remote service and policy enforcement.

Benefits to Manufacturers:

Because it is plug-and-play, 1394 confers all the same benefits as USB to manufacturers in terms of ease-of-use and reduced customer support requirements. The user never needs to open the box. Because 1394 enables users ready access to rich digital content, it will make the PC more attractive, thereby driving revenues. The modularity offered by 1394 (in conjunction with USB) offers PC manufacturers a greatly simplified manufacturing process and lower inventories in both the factory and in the field. Peripheral manufacturers benefit from compliance to a single industry standard supported by both the consumer electronics and computer industries, allowing in many cases the same SKU to be sold into both markets.

Industry Status:

IEEE 1394.1995 is in production today in consumer electronics equipment. An enhancement, called P1394a, is expected to go to the IEEE for balloting by January 1998, though many manufacturers are already incorporating features from P1394a in their silicon. In November 1997, Rev. 1.0 of the **Open Host Controller Interface (OHCI) specification** was released to the industry. You can download this from the internet at (<ftp://www.austin.ibm.com/pub/chrptech/1394ohci/>). The industry is actively working on closing the definition of P1394b, which will define 1394 at speeds of 800 Mbps and beyond. Intel expects chip sets supporting the 1394 Open Host Controller Interface to be available in 1998.

The transfer of copy-protected digital content, particularly video, over 1394 and other buses is a pressing issue for the movie and recording industries. Intel has developed a proposal, in conjunction with partners, for content protection and device authentication that is currently being evaluated by the Digital Transmission Discussion Group. You can download an overview of that proposal at the top of this page.

Next Steps:

PC system vendors and peripheral manufacturers: make plans now to support 1394 ports on your future systems if you haven't already. Conform as much as you can to the proposed P1394a specification. Also, use S400 speeds in new products to minimize the usage your device makes on the 1394 buses' bandwidth. Everyone, including consumer electronics manufacturers: ensure your 1394 interfaces are defined in compliance with the IEEE specifications and 1394 Trade Association guidelines to ensure interoperability.

Register for the **February 17-19 Intel Developer Forum - External Interconnect Technologies track**. Intel's top architects will discuss USB and 1394 implementation techniques. Visit the **IDF web site** for all the details today (<http://developer.intel.com/design/idf>).

For More Information:

Contact the **1394 Trade Association** site for more information on 1394 and links to many other 1394-related sites (<http://www.1394ta.org>).

Instantly Available PC Technology

What's New:

- Intel power management architect Gary Solomon describes how the **new 3.3Vaux ECR** provides the industry's **first standard approach** to supporting power-managed PCI device wakeup for easy implementation in the Instantly Available PC
(<http://developer.intel.com/solutions/archive/issue4/stories/top4.htm>)
- **Updated**; Version 1.1 of the **Instantly Available PC Power Management Design Guide**
(<http://developer.intel.com/design/power/pcpower.htm>)
- New PCI SIG Steering Committee approved **3.3Vaux ECR for PCI-PM**, developed to enhance the base PCI 2.1 specification for device wakeup, is **now available for download**
(<http://developer.intel.com/design/power/pcipower.htm>)
- See the latest updates to the Instantly Available PC **Power Delivery Requirements and Recommendations revision 0.9** (a.k.a Power Supply '98)
(<http://developer.intel.com/design/power/supply98.htm>)
- Intel Announces the **Mobile Power Guidelines Version 1.0** targeted at special considerations for achieving ultimate power efficiency in Mobile PCs.
(<http://developer.intel.com/design/mobile/intelpower/>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The Instantly Available PC is a new way of viewing power management requirements for today's fully featured home or office desktop PC. The goal of the Instantly Available PC is to have a high-performance, feature-rich PC that is power efficient when active and idle, always connected even when "off," and "instantly available" to users whenever needed. The Instantly Available PC is made up of several industry standard ingredients:

- ACPI (Advance Configuration and Power Interface) provides a standard yet flexible interface between hardware and applications to communicate their power management capabilities to the operating system.
- PCI-PM (PCI Power Management) allows add-in cards to participate in the overall power management scheme and introduce a new methodology to the scheme as well.
- A dual mode power delivery system as described by the Instantly Available PC Power Delivery Requirements and Recommendations. This power delivery system will provide clean and intelligent power under both heavy and light loads.
- An ACPI enabled OS will combine the above ingredients to create an intelligent power management platform.

Benefits To Users:

Because of the Instantly Available PC, home users will experience a PC that behaves much like a consumer electronics device. When it is not active, it appears to be off—there is no noise, no heat and very low power consumption, but it's ready in an instant. With the ability to be connected to external consumer electronic devices via **USB** (<http://developer.intel.com/solutions/tech/usb.htm>) and **1394** (<http://developer.intel.com/solutions/tech/1394.htm>) ports, the Instantly Available PC will be the hub of the entertainment center. For example, when you insert your DVD movie, your PC would wake itself up

and send the decoded video and audio signals to your ACPI aware TV and amplifiers after it woke them up too. The Instantly Available PC will deliver a whole new level of usability and robustness, giving us new capabilities for the PC platform touching multiple aspects of everyday life.

For the office PC, the Instantly Available PC has additional benefits with the ability to resume on a LAN event. Intel's **Wired for Management initiative** (<http://developer.intel.com/solutions/tech/wfm.htm>) specifies remote wake-up policies and procedures to help IT lower the TCO (Total Cost of Ownership). These can be implemented with the Instantly Available PC. No longer will IT managers have to worry about a PC being turned off and unable to get a software update packet at night. Energy savings due to power management are apparent, but your cooling cost throughout the entire campus will be lowered too.

Benefits To Manufacturers:

The Instantly Available PC combines an industry set of standard power management specifications that peripheral vendors and PC OEMs can develop products around. This ensures that all products will correctly work with each other and will be able to fully take advantage of the system power management scheme. By adhering to industry-established standards for power management, PC OEMs and peripheral vendors will not have to bear any additional R&D cost associated with developing an Instantly Available system or peripherals. By broadening the PC platform's capabilities we open the door up for different products that we can connect to the PC and enhance the users' experience.

Industry Status:

Intel, Toshiba*, Microsoft* and many other PC manufacturers are working on bringing ACPI platforms and peripherals to the PC community in 1998. Microsoft has announced that its next versions of Windows* 95 and Windows NT* will be fully ACPI compatible. PC and peripheral manufacturers should provide full ACPI implementations by the third quarter of 1998. PCI-PM is now available from the PCI industry special interest group and with the addition of the 3.3Vaux ECR to the PCI-PM specification, vendors now have a standard way of supporting PCI device wakeup.

On September 29, 1997, Intel hosted a full day Power Management technology training track at the Intel Developer Forum. Attendees received one-on-one access to Intel architects, a complete collateral package of specifications, tools, and design guides necessary to implement an Instantly Available PC. Don't miss the next **Intel Developer Forum** on February 17-19 (<http://developer.intel.com/design/idf>) for the best training on the Instantly Available PC, as well as implementing the hottest technologies driving the PC platform today. Register at the **IDF web site** today before time runs out.

Coming February 9-10, 1998 is the ACPI Implementation Workshop in Burlingame, CA. The Workshop is a hardware and software compatibility testing event and technical seminar. Testing and education are the principal focus of the Workshop. Technical experts from Intel, Microsoft and Toshiba will be available to answer questions and assist with testing. Participants are encouraged to stop by the Intel Instantly Available suite to test out their products on the fully ACPI compliant Instantly Available PC platform. For more information on this event visit. (<http://developer.intel.com/design/mobile/acpi.htm>).

Intel also recently announced the Mobile Power Initiative targeted at achieving power efficiency for Mobile PCs in the 1999 timeframe. Not only has Intel recently announced the Pentium® processor with MMX™ technology at 266MHz to increase performance and decrease power, it has introduced the Mobile Power Initiative to focus on System Hardware, System Software, and Application Software. The new **Mobile Power Guidelines** (Version 1.0) are now available for download (<http://developer.intel.com/design/mobile/intelpower/>).

Next Steps:

Peripheral Developers and OEMs should become familiar with the key ingredients for the Instantly Available PC. Download and understand the specifications for each. Available now for download at (<http://www.teleport.com/~acpi>) is the **specification for ACPI**, and the **PCI-PM specification** is available at (<http://www.pcisig.com/pm10.pdf>). All the other necessary specifications for implementing an Instantly Available PC can be downloaded at Intel's **PM spec site** (<http://developer.intel.com/ial/powermgm/specs.htm>). Modem and network communications vendors should pay special attention to the PCI-PM 3.3 Vaux ECR, as a solution to enabling communications on a power managed platform. (<http://developer.intel.com/design/power/pcipower.htm>)

For Mobile PCs, you should become familiar with the Mobile Power Initiative and Mobile Power Guidelines to start designing for ultimate power efficiency in your next designs.

Register for the Intel Developer Forum - Instantly Available PC Power Management track - to get the latest information on Instantly Available PC implementation. Register today at the **IDF web site** (<http://developer.intel.com/design/idf>) before time runs out.

For More Information:

The **Instantly Available PC Power Management Design Guide** for desktop platforms (<http://developer.intel.com/design/power/pcpower.htm>)

Get the latest Instantly Available PC **Power Delivery Requirements and Recommendations** (a.k.a Power Supply '98) (<http://developer.intel.com/design/power/supply98.htm>)

Intel power management architect **Gary Solomon describes the ins and outs** of the Instantly Available PC in a Top Story from Issue #2 of Platform Solutions (<http://developer.intel.com/solutions/archive/issue2/stories/top2.htm>)

For a **closer look at ACPI** (<http://www.teleport.com/~acpi>)

The **Mobile Power Initiative and Mobile Power Guidelines** designed to increase power efficiency in Mobile PCs (<http://developer.intel.com/design/mobile/intelpower/>)

PC 98 and PC 99 Technology

What's New:

- **Review Dates Planned for PC 99 Design Guide; More Details below in Industry Status**

The first industry preview of the proposed design guidelines for PC 99 will be published on the Intel and Microsoft* web sites in early February. This guide is co-authored by Intel Corporation and Microsoft Corporation. As with previous draft design guidelines, OEMs and IHVs are strongly encouraged to review and comment on the proposed PC 99 guidelines, and the industry is also encouraged to contribute additional issues to be considered for inclusion in the guidelines. Please see the details below on review deadlines, call to action, and links to the review web sites.

(See Industry Status below)

- **Latest Updates to PC 98 System Design Guide will be posted here every month!**

***PC 98 Correction-Chapter 15, item #20**, "Video input or capture device supports capture of NTSC/PAL picture quality": Video decoders must be capable of decoding 4:3 aspect-ratio, 720x480/720x576 resolution at 30/25 fps at 16 bpp. Decoding of YUV4:2:2 data format is also required.

- Download the complete **PC 98 System Design Guide 1.0** or view it online Now!
Co-authored by Intel Corporation and Microsoft Corporation*
(<http://developer.intel.com/design/pc98/index.htm> or <http://www.microsoft.com/hwdev/pc98.htm>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The PC 98 System Design Guide describes and recommends how a range of PC platforms should be designed to enhance user experience and satisfaction. PC 98 covers mobile PCs, business and consumer PCs, entertainment PCs and workstations that will ship from mid-1998 through 1999. Hand-held devices running Windows CE* and servers are not included in the PC 98 document.

(For information on Server design, check out the new **Hardware Design Guide for Windows NT* Server** just announced by Intel and Microsoft

(<http://www.intel.com/pressroom/archive/releases/SP110497.HTM>).

The PC 98 System Design Guide is divided into four parts. Part 1 covers upcoming technologies that will be available in the 1998 and 1999 time frame. Part 2 contains a rigorous description of System Types—most of this section describes a Basic PC 98 from which a Business, Consumer or SOHO (Small Office Home Office) desktop can be derived; two styles of Entertainment PCs, a two-foot viewing experience and a 10-foot viewing experience are described. Mobile design considerations are covered in a separate chapter, as are Workstation design issues. Part 3 describes expansion bus options such as USB, IEEE 1394, PCI, SCSI and other industry specifications. Part 4 details how add-in and add-on devices should be designed; many new technologies and specifications are introduced in this section.

Industry preview dates have now been set for the PC 99 Design Guide (see Industry Status below).

Benefits to Users:

PC 98 describes the introduction of new technologies into PC designs that are becoming more tailored for specific uses in the business and consumer markets. These new technologies and platform designs are intended to increase the utility and ease of use of the PC for different kinds of tasks and offer more choices to businesses and consumers. The overall goal of PC 98 is to address the expanding uses and users of PC technology, and to enhance the user experience and satisfaction.

By writing this document together, Intel and Microsoft are ensuring that the enabling hardware and supporting software will be available at the same time. The lead-time for new hardware designs and for software device drivers is being overlapped to shorten the time to a working, available solution. This up-front cooperation and planning will result in a better user experience.

Benefits to Manufacturers:

Introducing multiple new technologies into the existing PC platform infrastructure could create numerous problems. By working together and with industry experts, Intel and Microsoft have identified a variety of solutions and are creating new industry specifications, or supporting existing industry specifications, to ease rapid and successful absorption of these new technologies. By driving open specifications, Intel can also encourage innovation throughout the multiple PC platform design choices.

Industry Status:

The first industry preview of the proposed design guidelines for PC 99 will be published on the Intel and Microsoft web sites in early February. This guide will be co-authored by Intel Corporation and Microsoft Corporation. As with previous draft design guidelines, OEMs and IHVs are strongly encouraged to review and comment on the proposed PC 99 guidelines, and the industry is also encouraged to contribute additional issues to be considered for inclusion in the guidelines.

PC 99 draft and review process deadlines (planned):

February 6	First industry preview draft posted on Intel and Microsoft PC 99 web sites.
February 23	Industry comments due on preview draft
March 6	Second industry review draft (version 0.5) posted on PC 99 web sites.
April 6	Industry comments due from reviewers.
Week of April 20 (est.)	PC 99 Design Review with co-authors by invitation for reviewers who have previously submitted comments.
May 15	Version 0.9 draft posted on PC 99 web sites.
June 15	Version 1.0 posted on web sites.

The review drafts will be provided as a set of changes and additions to the PC 98 guidelines. After review and revision of the PC 99 changes, a final draft will be prepared for distribution on the Intel Developers web site and the Microsoft Hardware Development web site. The complete design guide text will be published in book form later in Q3 1998.

Call to action for PC 99 Design Guide draft:

If you want to be registered as a PC 99 reviewer, please send e-mail to pc99@Intel.com. Please include your name, title, company name, and phone and fax numbers. Also, please note that all mail received at this alias is shared among the co-authors at Intel and Microsoft.

For up-to-date information about the PC 99 draft and review process:

Intel's PC 98 web site (<http://developer.intel.com/design/pc98/index.htm>)

Microsoft web site (<http://www.microsoft.com/hwdev/desguid/>)

**** Updates will continue to be posted in Platform Solutions newsletter on this page on a monthly basis ****

Intel has been a behind-the-scenes contributor on previous versions of the PC 98 design guide. Due to the many projects Intel has on-going to introduce new hardware technologies and increase ease-of-use and end-user satisfaction of PC hardware, Intel's involvement in PC 98 has been growing. It was a natural fit to have Intel co-author with Microsoft on PC 98. Intel and Microsoft have both worked with the industry since February 1997 to review and improve the PC 98 System Design Guide in order to reach a releasable version.

Version 1.0 of the **PC 98 System Design Guide** was released to the industry in September 1997 and is now available for download from Intel's and Microsoft's web sites at

<http://developer.intel.com/design/pc98/index.htm> or <http://www.microsoft.com/hwdev/pc98.htm>.

Real time updates to the design guide will be posted in the "What's New" section at the top of this page every month.

On October 1, 1997 at the Intel Developer Forum, Intel hosted a full day technical training for hardware developers on PC 98 implementation. Intel's top architects spoke about three key implications for PC 98 hardware implementation: removal of the ISA Bus, Audio, and Graphics. Microsoft joined Intel at IDF to speak on Driver Quality. To view all of the PC 98 IDF presentations, please visit **Intel's PC 98 web site** (<http://developer.intel.com/design/pc98/#IDF>). For detailed information on the next Intel Developer Forum coming on February 17-19, visit the **IDF web site** (<http://developer.intel.com/design/idf>). Further details will be provided, directly from Intel's top architects, on the latest technologies driving all computer platforms for 1998 and 1999.

Next Steps:

Download PC 98 - If you are currently designing PCs or peripherals for shipment after June 1998 and throughout 1999, the PC 98 System Design Guide is a "must-have" reference. It contains definitive information on the evolution of the PC platform, together with essential information for developers. Visit Intel's PC 98 web site for your copy today.

Register for the Intel Developer Forum - Register today for the **February 17-19 Intel Developer Forum (IDF)** (<http://developer.intel.com/design/idf>) to get all of the details on the hardware technologies driving all computer platforms for 1998 and 1999. Don't miss the opportunity to interface with Intel's top architects and other industry leaders at the February IDF.

Become a PC 99 Reviewer - If you want to be registered as a PC 99 reviewer, please send e-mail to pc99@Intel.com. Please include your name, title, company name, and phone and fax numbers. Also, please note that all mail received at this alias is shared among the co-authors at Intel and Microsoft.

For More Information:

Intel's developer web site also contains detailed design information on all aspects of PC design (<http://developer.intel.com>).

Read an overview of three key technology implications of PC 98 in "**PC 98: Keeping the PC Platform Balanced**," by John Hyde, Intel's PC 98 Architect and Design Guide Editor in Issue #2 of *Platform Solutions* (<http://developer.intel.com/solutions/archive/issue2/stories/top5.htm>).

Read an overview of PC 98 and Intel's role in "**Leading the Way to PC 98**," by Jim Pappas, Director of Platform Initiatives at Intel from Issue #1 of *Platform Solutions* (<http://developer.intel.com/solutions/archive/issue1/stories/pc98.htm>).

See the other "Platforms" and "Technologies" pages of **Platform Solutions** for the latest news and information on PC technologies found in PC 98 (<http://developer.intel.com/solutions/>).

For information on server platform design, check out the **new Hardware Design Guide for Windows NT* Server** announced by Intel and Microsoft (<http://www.intel.com/pressroom/archive/releases/SP110497.HTM>).

Platform Performance Tuning Technology

What's New:

- Training seminars on IPEAK tools at **February 17-19 Intel Developer Forum**
(<http://developer.intel.com/design/idf>)
- Matt Gordon, Intel IHV Ingredient Marketing Manager, fully describes Intel's **new platform performance tuning tools** in *Platform Solutions*—Issue 2
(<http://developer.intel.com/solutions/archive/issue2/stories/top3.htm>)
- **New Intel Performance Evaluation and Analysis Kit (IPEAK)** web site available
(<http://developer.intel.com/design/ipeak/>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

One of the principal barriers historically confronting PC OEMs and IHVs has been a general lack of performance tuning tools designed to accelerate their hardware development efforts. For the most part, development tools for performance optimization and design analysis are typically developed internally by OEMs and IHVs themselves. In order to accelerate new platform technology adoption and optimize platform performance, Intel is sharing the results of its R&D efforts and making available a new line of development tools, previously used internally by Intel engineers and architects, to the broad PC industry.

At the last Intel Developer Forum (IDF) on September 29, Intel announced the new family of performance evaluation and analysis tools called the Intel Performance Evaluation and Analysis Kit (IPEAK) to be available in Q1 1998. IPEAK tools help ease technology adoption and platform performance tuning for PC OEMs and Independent Hardware Vendors (IHVs). As the first offerings of their kind in the industry, the IPEAK tools help shorten product time-to-market cycles when adopting new platform technologies and standards. The tools also provide automated testing solutions that reduce the time spent on testing during the system validation process.

The new IPEAK offerings include the IPEAK Power Management Toolkit, the IPEAK Storage Toolkit and the IPEAK Graphics Toolkit:

- **IPEAK Power Management Toolkit** consists of one tool—the *Power Management Analysis Tool (PMAT)*—developed to help PC OEMs and IHVs incorporate the Advanced Configuration and Power Interface (ACPI) power management initiative into their product design and system integration processes. It also helps to qualify power management functionality, quantify power consumption and test the behavior of applications that incorporate Global System Power Management functionality.
- **IPEAK Storage Toolkit** consists of four tools—*RankDisk*, *AnalyzeDisk*, *Win32 Tracking Kit*, and *AnalyzeTrace*—developed to help vendors identify optimal storage performance at low cost in product designs. In addition, these tools help PC OEMs and IHVs to select the best possible performance storage products at the same price point.
- **IPEAK Graphics Toolkit** includes two tools. The *Graphics Performance Toolkit* provides a better understanding of the performance issues and limitations related to graphics hardware and applications. And the *Baseline AGP System Evaluation Suite (BASE)* is a system integration and validation tool that provides the capability to test and evaluate **AGP** system-level functionality and utilization (<http://developer.intel.com/solutions/tech/agp.htm>).

Benefits to Manufacturers:

The new IPEAK toolkits make it easier for OEMs and IHVs to understand performance issues and limitations that can be addressed in the design process to optimize product performance. For example, IHVs can use these tools to detect any performance pitfalls and make corrections while in the pre-production stage, thus lowering the risk of accruing additional costs and delays in their product shipment schedules.

Benefits to Users:

In addition to the benefits they provide for manufacturers, the IPEAK toolkits will help Information Technology (IT) managers to evaluate and select products with increased performance when engaged in system integration activities, or when making decisions related to hardware configuration. Equally significant, the tools benefit users by ensuring that the PCs they purchase have been configured in ways that optimize their performance, functionality and reliability. End- users will be able to fully realize the performance capabilities of new processors, including the Pentium® II processor, combined with new platform technologies.

Industry Status:

Many PC OEMs, IHVs and ISVs have joined the IPEAK tools beta program since Intel announced the program in October of '97. Intel has received much valuable feedback from the industry on usability and functionality of the tools and is working to incorporate this feedback into the upcoming product release version of the tools. More details on the IPEAK tools product availability information will be made available next month. Stay tuned. To those companies who have joined the IPEAK beta program, the IPEAK team at Intel would like to express its appreciation for your support and feedback of the IPEAK tools.

Next Steps:

PC OEMs and IHVs can get up to speed on the IPEAK offerings by accessing information available on the IPEAK web site, and by continuing to check the status posted on this news page in *Platform Solutions* every month.

Intel will offer training seminars on all IPEAK tools at the **February 17-19 Intel Developer Forum**. During the training seminars, all the features and functionality of the IPEAK tools will be discussed in details. Most important you will learn first hand from the experts who developed the tools the methodologies behind the tools, the correct way to interpret the results, and ways to tune products for better performance and validate your products quickly. To Register for the conference, visit the **IDF web site** (<http://developer.intel.com/design/idf>) for all the details.

For More Information:

For more details on the IPEAK tools, please check out the **IPEAK web site** (<http://developer.intel.com/design/ipeak/>).

Read the Top Story, **"Introducing Intel Platform Performance Tools,"** by Matt Gordon—Intel IHV Ingredient Marketing Manager—in Issue 2 of *Platform Solutions* (<http://developer.intel.com/solutions/archive/issue2/stories/top3.htm>).

For more information on Power Management technologies, please visit the **Instantly Available PC** technology page in *Platform Solutions* (<http://developer.intel.com/solutions/tech/power.htm>).

For more information on Accelerated Graphics Port (AGP) technology, please visit the **AGP technology page** in *Platform Solutions* (<http://developer.intel.com/solutions/tech/agp.htm>).

Industry Events:

1394 TA Work Group Quarterly Meeting

January 26-29, San Francisco Airport, CA, USA

This is a quarterly meeting of the 1394 TA organization working group. This meeting will be hosted by Sun Microsystems* and held at the Hyatt Burlingame Airport in San Francisco.

For more details on the agenda, please visit the **1394 TA web site**
(<http://www.1394ta.org/upevents/upevents.html#jan27>)

Smart Battery System I/F Developers Conference & Interoperability Workshop

February 2-4, Maui, Hawaii, USA

The event is being held in Hawaii to make it more convenient for Japanese and other Asian professionals to attend. The conference will give system designers and battery manufacturers the opportunity to talk to the top technical experts for SBS, ACPI and SMBus. Speakers, from both the industry and the press, will conduct starter and advanced tutorials on SBS architecture, the SMBus protocol, operating system support via ACPI, SBS as a component of PC 98, hand-held device issues, addressing and more. Safety issues and guidelines will also be covered. Discussions as to the future of the specification will be open to all participants. The Interoperability Workshop ("Plugfest VI") will be held at the same time.

For more information and registration, please visit the **SBS I/F web site**
(<http://www.sbs-forum.org/marcom/devcon.htm>)

Accelerated Graphics Port (AGP) Plugfest

February 10-13, Milpitas, CA, USA

The AGP Plugfest is for manufacturers of AGP-enabled motherboards, systems, graphics controllers and add-in cards to test interoperability. Testing is done in a private, one-on-one, nondisclosure environment without competitive pressure. In addition to the typical functional tests, including electrical, BIOS, and platform interoperability, there is also thermal testing and training. This event is for members of the AGP Implementers Forum only.

For more details and registration, please visit the **AGP I/F web site** (<http://www.agpforum.org/>)

Intel Developer Forum

February 17-19, San Jose, CA, USA

Go "*Beyond the Spec*" at this second bi-annual hardware developer event hosted by Intel, at the San Jose Convention Center. The Intel Developer Forum (IDF) is the industry's premier event for hardware developers. Get implementation tools, detailed training and knowledge, directly from Intel's chief technology architects, on the latest technologies driving the hardware platform. IDF covers today's implementation details and tomorrow's technology roadmaps, to help speed the development of new products integrating the current advancements in desktop, mobile, workstation and server platform technologies. In addition, IDF provides a valuable opportunity to establish and strengthen personal working relationships with technology leaders from throughout the PC industry, and from around the world.

For more details on the IDF technical tracks and registration, please visit the **IDF web site** (<http://developer.intel.com/design/idf>)

Intel Developer Forum DVD Plugfest

February 24-26, Milpitas, CA, USA

This "Plugfest" event, held at the Milpitas Embassy Suites the week after the Intel Developer Forum, will involve interoperability testing of various components of DVD playback for personal computers. Vendors of DVD drives, graphics cards, MPEG hard and soft decoders, OEMs of personal computers, and software content providers will convene to test their products for compatibility over a 3 day period. Stay tuned to Platform Solutions for more information on this event in the future. Register for this event today by visiting the **DVD Plugfest web site** (<http://industry-enabling.org/plugfest.htm>)

Spring Internet World 98

March 11-13, Los Angeles, CA

Internet World is the industry's oldest and largest Internet, Intranet and World Wide Web event. Internet World events include all categories of products and services within the Internet industry and attracts all segments of the computer industry. For more details and registration, please visit the **Internet World web site** (<http://events.internet.com/spring98/spring98.html>)

CeBIT

March 18-25, Hannover, Germany

Europe's premier computer, telecommunications, and Information Technology industry fair. For more details, please visit the **CeBIT web site** (http://www.messe.de/cb98/index_e.html)

WinHEC

March 25-27, Orlando, FL, USA

Windows* Hardware Engineering Conference to be held at the Orange County Convention Center. PC industry event for manufacturers and suppliers of hardware products supporting Microsoft* Windows* family of operating systems. WinHEC brings together technical managers and product developers to examine new technologies for designing future Windows based computers.

For more details and registration information, please visit the **WinHEC web site** (<http://www.microsoft.com/hwdev/winhec.htm>)

Comdex® Spring '98

April 20-23, Chicago, IL

Key international event for the entire computer industry. For more information please visit the **Comdex Web site** (<http://www.comdex.com>)

Intel Networking Events & Training

For Intel's events and training programs on networking products and technologies, please visit the **Intel networking events page** (<http://www.intel.com/network/events/index.htm>)

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